Can Science Dispense With Religion?

Edited by

Mehdi Golshani

Institute for Humanities
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To this [sphere of religion] there also belongs the faith in the possibility that the regulations valid for the world of existence are rational, that is comprehensible to reason. I can not conceive of a genuine scientist without that profound faith. The situation may be expressed by an image: science without religion is lame, religion without science is blind.

Albert Einstein

When we consider what religion is for mankind, and what science is, it is no exaggeration to say that the future course of history depends upon the decision of this generation as to the relations between them. We have the two strongest general forces (apart from the mere impulse of the various senses) which influence men.

Alfred North Whitehead

IHCS

This book is an attempt to clarify various aspects of the relation between science and religion. Eight questions were sent to many believing scholars. Thirty scholars answered the questions directly, and two responded by sending full length essays.

A common theme between all of the contributions to this anthology is that both religion and science contribute to a better understanding of nature, and together they provide a deeper vision of our universe.

In the Name of God

The Most Merciful

The Most Compassionate

(Courtesy of Soroush Publications)

Can Science Dispense With Religion?

Edited by
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PREFACE

This book attempts to clarify various aspects of the relation between science and religion. The scholars who contributed to this anthology are all theists who believe that both science and religion are important aspects of our lives and neither one should be sacrificed for the sake of the other, and that there is no conflict between them if they are properly understood and if the domain of each one is correctly recognized and preserved.

We sent the following eight questions to many scientists, philosophers and theologians:

1. *What is your definition of science and religion?*
2. *Do you see any conflict between your definitions of these two concepts?*
3. *Where do you think there may be a conflict between these two?*
4. *What have been the grounds for the development of conflict between these two?*
5. *What has been the role of religion in the development of science in the West?*
6. *Can we have a religious science?*
7. *Can science dispense with religion?*
8. *Can one separate the domains of activity of science and religion completely?*

Thirty scholars answered the question directly. Dr. P.E. Hodgson and the late Professor K.V. Laurikainen responded by sending full length essays.

Six of the scholars interviewed for this anthology are Muslims, the rest are Christians (Catholic, Protestant or Orthodox).

We hope that this anthology will contribute to the illumination of the relation between science and religion, and that it will encourage further dialogues on this vital issue.

Mehdi Golshani

INTRODUCTION

Science and religion need each other. None of the two will be sufficiently close to its meaning without taking the other one absolutlely seriously.

Carl Friedrich v. Weizsäcker[1]

In the Middle ages teleology played an important role. The philosophy behind this was that everything has a special place in the hierarchy of the created world, because it is created by a God who has a designed telos to the universe.

It was during the same era that Aristotlian philosophy was synthesized with the Christian theology. The architect of this synthesis was Thomas Acquinas, who believed that reason and revelation cannot be in conflict. According to him, God is both the Creator and the Sustainer of the universe. God usually acts through natural means, but He occasionally manifests His power through miracles.

In the seventeenth century, modern science was developed in the hands of Descartes, Galileo, Newton,$\cdots$. The main characteristics of this science was mathematical argumentation and experimental observation.

In this science, teleology was left aside and the description of phenomena became the goal. **Descartes**, who was a theist, tried to explain the world mechanically. In his word:

Give me matter and motion and I will construct the univers.[2]

Following Descartes, **Hobbes** restricted the existence to the material world, and denied that any supra-material force can affect the material world. Galileo, who was a theist, considered the world to be made of particles which have two primary properties: mass and velocity. Galileo saw no conflict between his religious convictions and his scientific ideas, because God is the author of both the *book of Nature* and the *book of Scripture*. But, the holy book's role is to lead to the spiritual and moral

1. From Prof. von Weizsäcker's response to our questionaire.

2. S. Jaki, *The Relevance of Physics* (Edinburg: Scottish Academic Press, 1992), p. 111.

development of humans. It does not provide us with scientific facts. In Galileo's words:

> *God has endowed us with senses, reason and intellect· · · would not require us to deny senses and reason in physical matters which are set before our eyes and minds by direct experiences or necessary demonstrations.*[3]

Newton and his followers developed the mechanical pictures of the universe. In the Newtonian view, the universe is like a complicated machine that follows exact laws. Newton, himself, considered this machine to be the creation of God, and he even considered a continuing role for God in giving equilibrium to the solar system, safeguarding it from perturbations. Lagrange and Laplace pointed out that perturbations in the solar system never exceed a certain limit and this is taken care of automatically. There is no need for God's intervention. Thus, the idea of filling gaps in the scientific knowledge, by appeal to God, fell out of favor. Furthermore, the mechanistic model of the universe strengthened the position of deists who restricted God's action in the physical world to the initial creation. This diminished God's involvement with the world so much that it led ultimately to atheism.

On the other hand, the founders of modern science considered the study of nature as a study of the signs of God in nature and they interpreted the presence of order in natural phenomena as an indication of God's supreme Knowledge and Wisdom. In Newton's words:

> *This most beautiful system of the sun, plantes and comets could only proceed from the counsel and dominion of an intelligent and powerful being.*[4]

These pioneers were explicitly asserting that their main motivation for scientific endeavour was access to God's wonderful handiwork. As Leibnitz put it:

> *It is especially in sciences· · · that we see the wonders of God, His Power, Wisdom and Goodness · · · i.e. why, since my youth, I have given myself to the sciences that I loved.*[5]

But, with the passage of time, this outlook lost its appeal and the

3. S. Jaki, op. cit, p. 422.
4. Ibid. p. 437.
5. Ibid., p. 428.

dependence on human reason became more and more dominant. This affected theology very seriously and the role of religion became limited to moral issues. Several factors were effective in the establishment of *scientism* during the eighteenth and nineteenth centuries, a doctrine which holds that science can explain everything and there is no need to bring God in:

1. **The appearance of Darwinism in the mid-nineteenth century.**

Darwinism confronted religion in four fronts by:

- disputing *the argument from design* (through describing the order of the biological world by Darwinian natural selection).
- disputing the real distinction of humans from other animals.
- disputing religious moral codes.
- disputing the special creation of mankind.

2. **The prevalence of Empiricism.**

The doctrine of empiricism claims that the senses are the only sources of knowledge. Thus, metaphysical concepts should be eliminated from any physical theory, because they are not rooted in sense experience. This doctrine is an old one, but it got prominance with the works of the British empiricists of the seventeenth and eighteenth century and was fortified by the positivism of August Conte and the logical positivism of the "Vienna Circle" of the 1920s and 30s. A common feature of all schools of empiricism is that they give primacy to sense experience and reject metaphysics.

It was claimed by empiricists that the methods of experimental knowledge are universal and that they should be used in all fields of knowledge, including humanities. Thus reductionism (both espistemological and ontological) became the rule of the game, and it was said that everything is to be ultimately explained by the laws of physical science and that everything is to be reduced to matter. As **Condorcet** put it:

> *[Human and physical events] were equally susceptible to being calculated and all that is necessary to reduce the whole of nature to laws similar to those which Newton discovered with the aid of calculus, is to have a sufficient number of observations and mathematics that is complex enough.*[6]

And in the words of **Holbach**:

> *It is to physics and to experience that man must have recourse in*

6. S. Jaki, op. cit., p. 465.

> *all his investigations: he must consult them in matters of religion, ethics, legislation, political government, the sciences and the arts, even in his pleasures and suffering.*[5]

The doctrine of conflict between science and religion was developed by T.H. Huxley and his colleagues in the second half of the nineteenth century, and it was propagated by the works of two historians of science: J.W. Draper and A.D. White.

With the dominance of scientism in the second half of the nineteenth century, religion became more and more isolated and science became the religion of scientists and it became against fashion to speak of religious matters in the academic circles. This trend is still dominant. Thus, e.g. when the setting up of a lectureship in theology and natural sciences in the university of Cambridge in 1993 was announced, **Richard Dawkins**, an Oxford zoologist, wrote a letter to the editor of the *Independent*, in which he said:

> *Sir: In your dismally unctuous leading article (18 March) asking for a reconciliation between science and 'theology', your remark that 'people want to know as much as possible about their origins'. I certainly hope they do, but what on earth makes you think that 'theology' has anything useful to say on the subject? Science is responsible for the following knowledge about our origins.*[7]

and he concluded this letter with:

> *What makes you think that "theology" is a subject at all?*[8]

One can safely say that the main factor in weakening religion in our century is the prevalence of philosophies that rejected metaphysics and restricted knowledge to the experimental one.

In the last few decades, however, science has lost part of its soverignty and one notices a revival of interest in religion. Today scientists are much less arrogant and they are more cautious about the limits of science than they were, say, forty years ago. There are several reasons for this change of attitude. We just mention the most important factors:

• Some scientists have disputed the claim that science can answere ultimate questions of human concern. In the words of **J. Polkinghorn**:

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7. M. Poole, *Beliefs and Values in Science Education* (Buckingham: Open University Press, 1995), p. 35.

8. Ibid., p. 36.

I believe that, in principle, scientifically passable questions are scientifically answerable. We should use our scientific knowledge and abilities to learn all we can about the probable early history of the universe and about how inanimate matter complexified into living matter. However, other questions which we surely must ask – such as, why is there a world at all? Why is it the way it is in its given law and circumstance? Is there a purpose behind cosmic history? – are not scientific and require metaphysics for their answer. I find the most satisfying and comprehensive answer to be provided by theism.[9]

• It has been noticed that contemporary science is based on some controversial generalizations. For example, our knowledge about the early universe is so little that we should be careful in answering questions concerning the origin just on the basis of some transient theories. The American astrophysicist **J. Bahcal** has beautifully expressed the matter:

I personally feel it is presumptuous to believe that man can determine the whole temporal structure of the universe, its evolution, development and ultimate fate from the first nanosecond of creation to the last 10^{10} years on the basis of three or four facts which are not very accurately known and are disputed among the experts. That I find, I would say, almost immodest.[10]

and in the words of **John Pollinghorne**:

It is not obvious to me that it is feasible and sensible program to apply quantum mechanics to the whole universe. The universe is a different sort of entity from any subsystem contained within it; and because we do not actually understand how quantum theory relates to the everyday world, it seems to me slightly over ambitious to leapfrog that and apply it to the whole universe.[11]

Scientific speculations about domains which are out of our control or direct observation could not be used to settle basic problems of existence. One has to go beyond the domain of science to get a deeper understand-

9. H. Margenau and R.A. Varghese, eds., *Cosmos, Bios, Theos* (La Salle, III.: Open Court, 1992), p. 88.

10. E. Regis, *Who Got Einstein's Office*? (London: Simon & Schuster, 1988), pp. 210-11.

11. J. Polkinghorne, *Serious Talk* (London: SCM Press LTD, 1996), p. 31.

ing of them. As the American astrophysicist **R. Jastrow** put it:

> *We have no information whatsoever about what happened in the universe when it was younger than three minutes, and in particular, when it was 10^{-43} second old, and so on. It seems to me naïve to construct elaborate theories that propose to answer profound philosophical and religious as well as scientific questions, on the basis of speculation about an area never touched, directly or indirectly, by observation.*[12]

• It has become more and more clear that science cannot work without some meta-scientific assuptions: the assumption of reliability of senses-data, the assumption of comprehesibility of nature by human intellect, etc.

• Science cannot explain its own success, and it cannot rule out meta-scientific dimensions of the universe. In **Michael Poole**'s words:

> *It is no use going to science, which is the study of nature to try to find out whether there is anything other than nature to which nature owes its existence.*[13]

Gödel's incompleteness theorem has disappointed those who thought through mathematical physics they could explain everything. **Eugene Wigner**, Noble Laureate in physics (1963), elaborates on this point:

> *My best friend, John von Neumann, tried to prove the consistency of mathematics, and he was upset when Gödel proved that it cannot be proved. That was quite a shock to John von Neumann.*[14]

• Some religious scholars have tried to become experts in various areas of modern science and have tried to explore the common grounds of science and religion. On the other hand, some scientists have willingly exposed themselves to theological ideas, and, frequently, scientists, philosophers and theologians have become engaged in serious dialogue. Thus, they have got a better understanding of each other's position.

• Science has contributed much to the progress and welfare of mankind, but this has been at the expense of human values, and has considerably nullified the achievements of science. The two world wars of this century

12. H. Margenau and R.A. Varghese., op. cit., p. 47.

13. M. Poole, loc. cit., p. 38.

14. T.D. Singh and Ravi Gomatam, eds., *Synthesis of Science and Religion* (Bombay: The Bhaktivedanta Institute, 1987), p. 258.

showed that misguided science and technology could lead to destruction. Thus, it has become clear that science cannot provide a sense of direction and cannot bring peace and tranquility to human beings. The separation between science on the one hand and philosophy and religion on the other hand, has produced a gap between technical knowledge and the priorities of its applications. It is religion with its value system and intellectual and spriritual dimensions that can give proper direction to the use of technical knowledge.

In short, human experience has more dimensions than what science can accommodate. One needs a much larger framework to integrate all aspects of human experience. **Dr. R.L. Thompson** has put the matter nicely:

> *The understanding of nature as a machine has resulted in much technological progress, but now we find people throughout the world abandoning traditional ways of life to join in a struggle for technical supremacy – a struggle that culminates in the construction of more and more deadly machines of mass destruction.*
>
> *It can be argued that this trend of modern civilization has been strongly encouraged by scientific theories that appear to contradict any philosophy of life other than materialism. It may be very difficult to change this dangerous trend. But an essential ingredient for such a change could be the wide dissemination of a valid approach to scientific knowledge that allows for a tangible spiritual dimension to human life and is compatible with the ancient understanding that mankind is dependent on a transcendental Supreme Being. Such an approach opens up the possibility of directing human energy towards higher spiritual goals and of providing a solid ethical basis for the conduct of our material affairs.*[15]

• The program of reductionism, both epistemological and ontological, has been confronted with serious obstacles. Thus, there has been serious challenges to the reduction of the whole physics to the elementary particle physics or the reduction of life to microbiology. In the words of **Dr. Maurice H. Wilkins** (Nobel Laureate in Medicine, 1962):

> *But, I don't agree with the molecular biologists who think that the whole nature of life can be comprehended in terms of molecular*

15. T.D. Singh and Ravi Gomatam, op. cit., p. 235.

biology alone. I think that is a very simple minded, mechanistic way of thinking.[16]

In the last three decades, especially during 90s, we are seeing a noticeable movement towards religion and spirituality. As a witness to this movement, we just mention a few observations:

1. Popular books of eminent scientists, which bear the name of God (e.g. *God and the New Physics, The God Particle, The Mind of God*, etc.) have sold out, and their number is increasing. The main reason for popularity of these books is that people really want to remove any discrepancy between their faith and science.

2. During the last two decades, there has been an increasing number of conferences about the subjects of mutual interest between science and religion. An important and unprecedented aspect of these conferences is that they were interdisciplinary, i.e. they involved scientists, philosophers and theologians. Thus, they were very fruitful and enriching.

Also, there has been a very rapid increase in the number of science – religion courses offered by Western univeristies, and some universities have even started MA and Ph.D programs in science and religion.

Furthermore, several important research institutes have been established, which have been instrumental in setting up major conferences and publishing journals and books.

Finally, a large number of books have come out which have dealt with the problems at the interface of science and religion, illuminating various aspects of the relation between these two fundamental departments of human concern.

About thirty years ago Ian Barbour categorized possible ways of relating science and religion. His categories were: conflict, independence, dialogue and integration. At that time one could count most of the scientists and philosophers as belonging to the first two categories. Today, an increasing number of scientists believe in dialogue or integration, and some, including myself, consider scientific endeavour as part of religious experience. Furthermore, many scholars are seeking common grounds for discussion betweeen theology and science. Thus, science-religion dialogue has become very exciting, and science-theology venture seems very promissing.

To contribute to the good traffic between scientific and theological

16. T. D. Singh and Ravi Gomatam, op. cit., p. 33

ideas, the idea of preparing this book was conceived. Believing that:

– religion can accommodate scientific insights

– religion can give sense of direction to science

– both religion and science contribute to the understanding of nature, and together they provide a deeper vision of truth.

We sent a set of eight questions to many theist scholars of various disciplines and religious faiths. The responses are reproduced in the following pages.

A proper understanding of the relation between science and religion is of at most importance for sequring the spiritual welfare of all humanity. May this book contribute to a better appreciation of this relation.

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Postgraduate Experience: Curate, Edgware Parish Church 1983-86; Lecturer in Theology at the University of Nottingham 1990-1997; Senior Lecturer since 1997.

1. What is your definition of science and religion?

Science can be defined in its broadest sense as "an attempt at comprehension and exposition, at investigation and instruction, which is related to a definite object and sphere of activity" (K. Barth, *Dogmatics in Outline*, London 1949, p. 9). Science is a rational exercise. It is also an objective exercise in that the knower should be open to the disclosure of the object and ideally should not impose upon the object *a priori* assumptions about the object; rather he should be open to the object. Science also involves a combination of theory and practice but the precise way in which they are combined depends on the particular object of enquiry. This is my broad definition of science and such a definition would embrace theology. But there are many different sciences and each science requires a particular method which is suitable to the object of its enquiry. The particular science which these questions concern is natural science. Natural science includes disiplines such as physics, chemistry and biology. The object of enquiry is the natural world and in this an attempt is made to discern the "laws of nature" and the structure of the natural world whether that be an atom, a molecule or an organism. In such sciences thereis a particular combination of theory and experimentation. The knower does not come to the object of enquiry with no presuppositions. Rather he comes with some sort of hypothesis which in turn shapes the nature of the experiment. Hypotheses can then be revised or rejected on the basis of experiment.

Theology I would define as the science of God and in such a science it is necessary to have an appropriate method of enquiry. But I have been asked to define "religion". This is a little more difficult to define because there are many "religions" and the theological discussion about "religion" has been extremely complex. For example, many christian protestant theologians have been critical of "religion", seeing it as a human attempt to find God. K. Barth considered religion in one sense as unbelief (*Church Dogmatics*, 2.1: 297-325). Such a definition is not particularly helpful for this questionaire so I will adopt the following definition of F. Burmann (1632-79). Religion is "the right pattern of knowing and worshipping God" (*recta Deum cognoscendi et colendi ratio, Synopsis theologiae* 1.2.4, quoted in R. A. Muller, *Post-Reformation*

Dogmatics: Volume 1, Grand Rapids 1987, p. 117). Such a definition of "religion" is not that different from a definition of theology as the "science of God".

2. Do you see any conflict between your definitions of these two concepts?

If "religion" is related to "theology" as the "science of God", and if "science" (i.e. "natural science") is the "science of the natural world", there appears to be little or no conflict between the two. Each has its own sphere of activity. But in practice, there clearly has been some conflict between "science" and "religion".

3. Where do you think there may be a conflict between these two?

A conflict may arise where the two areas of "science" and "religion" overlap. I take the example of the origin of the universe. Genesis 1 of the Hebrew Bible says that God created the world in six days. The word "day" clearly means a period of 24 hours. See Exodus 20.911: "*Six days you shall labour... but the seventh day is a sabbath to the LORD your God... for in six days the LORD made heaven and earth, the sea, and all that is in them...*". Yet this clearly conflicts with the findings of astronomy, geology and biology. Using the Hebrew Bible James Ussher, Archbishop of Armagh and John Lightfoot, Chancellor of Cambridge University, calculated that God created the world in 4004 BC. Although there may be some disagreement among astronomers, geologists and biologists about the age of the universe, the earth and life, hardly any would accept that universe is just 6000 years old.

I have given an example where a religious text conflicts with the findings of science. Another example where science and religion can conflict is where science believes it has disproved some aspect of life which "religion" believes is crucial. So some have claimed that science has disproved the existence of the human soul. Scientists have not found a soul. Is the human being not simply a body, and is not our thinking just brain activity? So it is claimed that science can dispense with religion.

4. What have been the grounds for the development of conflict between these two?

One reason for the conflict is that "religion" has said something about the natural world which clearly does not fit in with the findings of science. This has been seen to be the problem in the case of the creation of the universe. Another reason for the conflict is when a reductionist view of science is adopted, that is that everything can be reduced to the lowest possible level of enquiry. Such a view is seen in my second example above, the case of the human soul. A human being is "nothing but" a collection of molecules and thinking is nothing but a series of electrical impulses in the brain.

5. What has been the role of religion in the development of science in the West?

Despite the conflict that has arisen between religion and science, it is striking that religion has been a key factor in the development of science in the West. I accept many of the conclusions of R. Hooykaas' book, *Religion and the Rise of Modern Science*, Edinburg 1984 (rep.), ([1]1972), that protestantism, especially Calvinism, played an important role in the development of science. So, for example, the positive attitude towards manual work in protestantism encouraged experimental science. Hooykaas also points to the striking way in which science flourished in 17th and 18th century protestant cultures. So, for example, when the Royal Society in England was founded in 1660-62 the majority of its membersf were Puritans (i.e. Calvinists). More generally, I believe one can make the following two points about the way religion has had a positive effect on the development of science in the West. First, if there is a God who created the universe, and if this God is rational, one may assume that the universe has an inherent intellegibility which reflects the rationality of God. Second, if one believes that nature itself is not divine, but rather is simply God's creation, it seems acceptable to do experiments on the natural world. The Greek view of the deification of nature may well have hindered the experimental aspect of their scientific work.

6. Can we have a religious science?

A religious science is possible in three respects. First, it may be possible to have a science based on religious principles (for example, a science where experiments are responsibly carried out, where there is respect for the environment, etc.). Secondly, it may also be possible to make certain judgements in science and in the philosophy of science based on theological principles. For example in Quantum Theory a religious science may involve realist view of the world (i.e. there is a universe existing independent of our observing it). So Einstein, a Jew, was unhappy with Quantum Theory as it was understood by physicists such as Niels Bohr. Further, Einstein had theological problems with the alleged indeterminacy in Quantum Theory. "God does not play dice". Einstein therefore believed that Quantum Theory was incomplete and would be superceded. The third way in which one can have a religious science is to consider that any science at its peak can become theology. K. Barth writes this: "*Theology does not in fact possess special keys to special doors. Nor does it control a basis of knowledge which might not find actualisation in other sciences. Nor does it know an object of enquiry necessarily concealed from other sciences... All sciences might ultimately be theology*", (*Church Dogmatics*, 1. 1. 5-7). But he goes on to write that science in fact has not become theology. "*The separate existence of theology signifies the emergency measure on which the Church has had to resolve in view of the actual refusal of the other sciences in this respect*" (7). Building on this, some scholars have gone on to speak of a necessary "liberation of science".

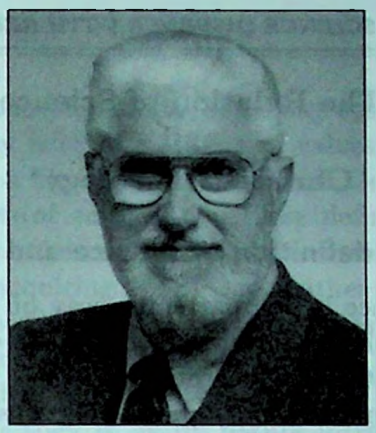
7. Can science dispense with religion?

In one sense it can, for science does appear to have a certain autonomy. So physics, for example, has is own language, logic and method. Some of the best physicists are atheists. However, science does have a metaphysical basis. It assumes the world is intelligible; it assumes that there are laws of science. Religion can provide science with precisely such a metaphysical basis. If God is rational his creation can have a certain intelligibility. There is no reason why the universe should be lawful. Religion can say that

the laws of nature reflect God's rationality; the laws of nature also reflect God's faithfulness.

8. Can one separate the domains of activity of science and religion completely?

As said above, science does rely on certain metaphysical assumptions which religion may be able to provide. So in one sense science needs religion. Does religion need science? Perhaps it does. As science develops, our world view develops, and it is necessary to restate the truths of religion in a new language. So in the light of Einstein's theory of relativity, our view of time has changed radically. Time cannot be separated from space; one must speak of space-time. So if God is outside of space he must be also outside of time. In certain respects, though, science and religion have to be separated. I mentioned earlier the conflict between religion and science in the matter of creation. The account in Genesis does not tally with modern science. But does not Genesis still have something to say? I believe it does. It is not a biology textbook. But it tells us that God created "Adam", the first man. He is the pinnacle of God's created order, created in God's image. But he sinned and turned away from God. He "fell" and was cast out of the Garden of Eden and a curse came upon creation. The Jew, Paul of Tarsus, who was converted to the Christian faith, said that we all participate in the fall of Adam (Romans 5.12-21). This is the fundamental human problem. Such language could be called mythological language. It is not the language the physicist would use, but it has its own validity. So the essential element in the creation account found in Genesis is not *when* God made the world or made Adam, but the fact that he made Adam as the highest thing in his creation. But Adam fell, a fall which has affected us all. We are under the power of sin, a power from which we need to be redeemed.



Prof. Richard H. Bube

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Post-Doctoral Professional Experience: Associate Professor (1962-64), Professor (since 1964), Department Chairman (1975-86), Associate Chairman (1990-91), Professor Emeritus (since 1992), Dept. of Material Science and Electrical Engineering, Stanford University. Adjunct Professor of Theology and Science at Fuller Theological Seminary, Pasadena (1974) and at Regent College, Vancouver (1976). He has lectured on science and Christianity on the campuses of over 60 colleges and universities since 1962.

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The Relation of Science and Christian Theology*

1. What is your definition of science and religion?

Authentic science is one particular way of acquiring knowledge, based on testable descriptions of the world obtained through the human interpretation (theoretical science) in natural categories of publicly observable and reproducible sense data (experimental science), obtained by sense interaction with the natural world. General characteristics of authentic science include the importance of presuppositional foundations; the role of science as the revealer of the mechanisms active in the world; the impersonal nature of science in which the scientist is the only person involved, with all the rest being objects of investigation; the ambivalence of science, since science does not automatically solve all of human problems; and the ethical silence of science that limits itself to describing "what is," not "what should be."

Rather than the rather vague word "religion," I prefer to speak of "theology" as the more appropriate counterpart of "science." Then authentic Christian theology is one particular way of acquiring knowledge, based on descriptions of the world obtained through the human interpretation of the Bible (with the guidance of the Holy Spirit) and human experience (interpersonal relationships). Science is the result of human interpretation of God's work in creation, and correspondingly theology is the result of human interpretation of God's revelation in the Bible and personal relationships (see Figure 1 later in this article). Authentic theology is personal, since it is concerned primarily with relationships between human beings and God, between human beings and one another, and with the healing of broken relationships; ambivalent, since theology is essential for a Christian life, but it is not from theology itself but from the experience of God's love, grace, and forgiveness in Christ that the basis and strength for that life

* This article is based on material from *Putting It All Together: Seven Patterns for Relating Science and Christian Faith*, by R. H. Bube, University Press of America, 4720 Boston Way, Lanham, Maryland 20706, USA (1995). All of the questions discussed in this manuscript, together with many others, have been treated in greater detail in this book.

proceeds; the basis for ethics, since any system of ethics requires the adoption by faith of a system of values; the foundation for a worldview and a life in relationship with God.

Major points of emphasis in these definitions are as follows. Both authentic science and authentic theology provide *one particular way* of acquiring knowledge; neither provides the only way to acquiring knowledge. The particular way in which science provides its knowledge is intrinsically different from the way in which theology provides its knowledge. Science is by design intrinsically impersonal; theology is by its nature intrinsically interpersonal. Acquiring knowledge in both cases is the result of human interpretation, not of some automatic totally objective process. Science is committed to providing interpretations that involve natural categories of description; if such natural categories are inappropriate for a specific instance, then nothing can be said about it on the basis of science alone.

Common features of authentic science and theology may be summarized as follows. (1) Both science and theology are based on faith commitments: a faith commitment to the intelligibility of the world and the "possibility" of doing science, on the one hand, and a faith commitment to God as most clearly revealed in the life and teachings, death, and resurrection of Jesus Christ on the other. All fundamental human choices start with faith commitments; science and theology are not exceptions. (2) Both science and theology develop descriptions of reality based upon evidence. The evidence that each produces is usually obtained in a different way, but neither establishes conclusions as the result of proof. (3) Descriptions of reality produced by science are able to be tested by human sense interaction with the physical world. Descriptions of reality by theology are able to be tested to some extent by human experience both in historical context and in the present. (4) Both authentic science and authentic Christian theology provide us with partial descriptions of part of reality. Neither provides us with complete or absolute descriptions of reality. But it is important to realize that a partial description may still convey valid insights into reality. Both science and theology provide us with insights into *what reality is like.*

Mention should be made of differences between various branches

of what have all come to be called science, in particular the physical sciences (physics, chemistry, geology, biology etc.) and the social sciences (psychology, medicine, political science, sociology etc.). In practice the physical sciences can follow a much more complete representation of the definition of authentic science given above, whereas the social sciences frequently involve inputs involving human opinions, beliefs, thoughts etc. Often the social sciences have separated into two parts, one seeking to follow the impersonal lead of the physical sciences and the safeguards associated with them, and the other recognizing the role of personal relationships and other inputs (e.g., research psychology vs clinical psychology, medical research vs practice of medicine etc.). To claim the same ultimate reliability for the social sciences as for the physical sciences can sometimes be misleading.

2. Do you see any conflict between your definitions of these two concepts?

There can be no ultimate conflict between authentic science and authentic theology, but it is important to emphasize the difference between "ultimate conflict" and apparent disagreements in specific cases. Also the claim that there is no conflict between authentic science and authentic theology is not based upon the compartmentalization of these two areas, so that it is impossible for an apparent disagreement to occur.

Authentic science and authentic theology do interact and provide complementary descriptions of the same reality. Both authentic science and authentic theology give us different kinds of descriptions of what reality is like; neither one ordinarily gives descriptions of what reality is. In an oversimplified way, scientific descriptions generally provide impersonal answers to "how" questions, whereas theological descriptions give personal answers to "why" questions. If we have both scientific and theological descriptions of the same areas of life, then we are called upon to integrate these two descriptions into a more complete description of what reality is like. Instances of apparent disagreement should lead to a re-examination of the interpretation involved in both authentic science and authentic theology, and to search for how

the two types of interpretations can be integrated in a way that is faithful to them both.

3. Where do you think there may be a conflict between these two?

Authentic science is to be differentiated from pseudoscience, which makes claims similar to those of authentic science, but is either (1) simply bad science (e. g., neglects important variables), (2) an attempt to do something that science cannot do (e. g., provide the basis for ethical values), or (3) an attempt to do scientific activity designed to support some previously accepted philosophical, metaphysical, religious or political ideology.

There is a parallel between pseudoscience and pseudotheology. Pseudotheology may be either (1) simply bad theology (e.g., ignores the principles of hermeneutics in biblical interpretation), (2) an attempt to do something that authentic theology cannot do (e.g., provide the basis for scientific mechanisms), or (3) an attempt to use theology in the effort to establish or justify a particular philosophical or religious ideology.

Conflicts that appear to occur between science and theology are often the result of attempts to include descriptions involving science and pseudotheology, pseudoscience and theology, or pseudoscience and pseudotheology.

4. What have been the grounds for the development of conflict between these two?

Two well-know examples of such a conflict are the result of the identification at a particular time of the currently accepted theological description and scientific description as finally established. It turns out that this may well be a combination of bad science with bad theology.

In the case of Galileo, it had been assumed that previous scientific models of a stationary earth with the sun revolving around it had a unique agreement with the theological descriptions of the centrality of earth's importance in human relationships with one another and with God. New scientific evidence that this was not

the case was interpreted as a denial of the traditional theological description that had been identified with traditional science. It was only when it was realized that the actual theological description was not uniquely related to the traditional scientific description that the appearance of conflict could be removed.

In the case of Darwin, it had been assumed that the traditional theological description involving instantaneous fiat creation in six days on a young earth was scientifically supported without any serious scientific evidence to the contrary. New scientific evidence that the earth is much older and that a process of evolution could be invoked to describe the development over time of living creatures on the earth, was interpreted as a denial of the traditional theological and scientific descriptions. It was only when it was realized that the actual theological description was not uniquely related to the traditional theological and scientific descriptions that the appearance of conflict could be removed.

It is always important to realize that some questions may need to remain at any particular time simply "open questions." If an interpretation derived from authentic science appears to be in conflict with an interpretation derived from authentic theology, it may be necessary simply to leave the final resolution of the issue open without forsaking the valid insights that we do have from authentic science and authentic theology. There are, of course, several possibilities: (1) our scientific interpretation may be incorrect or incomplete; (2) our theological interpretation may be incorrect or incomplete, (3) both our scientific and our theological interpretations may be incorrect or incomplete, or (4) both scientific and theological interpretations may supply us with valid insights into the resolution of the problem without giving us the detailed descriptions needed to simply consider the issue closed forever.

5. What has been the role of religion in the development of science in the West?

A major contribution of theology to the development of science in the West is found in the biblical teaching on Creation. The doctrine of creation identifies the universe and everything in it as the work of God, as something made by Him. As a consequence it

is a good and proper activity to attempt to understand this work of God in an orderly way, not to assume that God must have done what God could do, but to attempt to find out what God did by investigation of what He has done.

This knowledge is good in itself, "thinking God's thoughts after Him," and it is also essential for the fulfillment of the human role of caretakers of the creation. The understanding of the world as the work of God effectively desacralizes it, i.e., the objects in this world are regarded and respected as objects made by God, not as spiritual entities in themselves as in animism. The biblical concept of stewardship expresses our responsibility for the care of all things in the created universe that God has given into our trust: human beings, living creatures, land, water, air, energy, and natural resources. Both knowledge and commitment are required for the fulfillment of this stewardship, and science has been one of the ways in which the needed knowledge has been sought.

6. Can we have a religious science?

The answer to this question depends critically on what it actually means. If, for example, it means, "Can religious people do good science?" the answer is obviously "Yes". If it means, "Can we treat our theological approach to developing a worldview in exactly the same way as we treat our scientific approach?" the answer is "No". If it means, "Can our religion be an important factor in what kind of science we do?" the answer is "Yes". It it means, "Can we introduce religious concepts into our description of authentic scientific mechanisms?" the answer is "No".

Usually, however, it means something else; it is a call for what has also been called "theistic science." The insistence in our definition of authentic science that scientific descriptions must by definition be given in natural categories, seems to some to improperly exclude God from the scientific description of the physical world. They do not think that God's creation and sustaining of the natural world can be upheld as long as God's actions are not included as being appropriate mechanisms for a scientific description. The attempt to include direct divine action in the categories used in scientific descriptions, however, inevitably leads to a return to the

faculty position involving a God-of-the-Gaps. In this position the evidence for the existence and activity of God is found primarily in those regions of human ignorance, those gaps in human understanding, where descriptions in terms of natural categories have not been possible, i.e., evidence for God from the natural world is separated from evidence for God from His supernatural activity, only the latter being accepted. The unfortunate paradoxical result is that as more and more is known about God's natural activity, the less and less evidence there is for the existence of God!

The advocate of theistic science claims that unless God is admitted as a direct agent in scientific theories, then this is equivalent to saying that God cannot act as a primary cause directly. This is not true. In a case in which God acted directly as a primary cause, the pursuit of authentic science would lead to the conclusion that no scientific description is possible. It would then be appropriate to propose other possible situations such as the direct action of God as a primary cause.

7. Can science dispense with religion?

Since we have defined authentic science as being concerned with descriptions in natural categories, it might seem that a simple answer to this question would be "Yes". But that would be to forget that human life encompasses much more than is adequately described by science. Science as a strictly defined discipline might well exist unchanged without theology, but scientists as human beings could not. There are basic effects of religious commitment that extend beyond simply invoking acts of God as scientific mechanisms.

The biblical revelation provides insight into human nature. It raises the much needed warning against the supposedly unprejudiced objective conclusions of scientists. It provides the basis for human dignity and worth essential for determining how human beings are to be treated scientifically. It provides the guidelines to decide what kinds of scientific activities are to be given high priority and which are to be discouraged as much as possible. And it forms the foundation for dealing with the great number of ethical problems that modern science is encountering with ever greater frequency.

Figure 1

GOD

	creates	speaks
	↓	↓
Givens:	natural world	the Word of
	↓	↓
		God: the Bible
	↓	↓
Method:	human interpretation via scientific method	human interpretation via biblical hermeneutics
	↓	↓
	scientific description	theological description
to know	understand	to relate understand
	theoretical	theoretical
	human curiosity	human quest
to make	control	to serve service
	technological	living
	human responsibility	human call

THINGS	PERSONS
mechanism	meaning
probability	purpose
what? how?	why?
I-It	I-Thou
evolution	creation
chance	providence
body	soul
brain	mind
animal	human being
machine	creation of God
temporal	eternal
physical	spiritual
secular	sacred
survival	salvation

! BUT THE SAME REALITY !

8. Can one separate the domains of activity of science and religion completely?

Once again the answer to this question is either "Yes", if we focus on the actual operating practices of science and theology, or "No", if we focus on the fact that both authentic science and authentic theology provide valid insights into the nature of all of reality – the same reality for them both.

The main difference between science and theology is the kind of knowledge that each gives. These are illustrated in Figure 1 in an overly simplified way. Science primarily answers questions about "how" something happens, what mechanisms are acting in the universe for it to happen, and what are proximate natural causes for it. Theology primarily answers questions about "why" something happens, what the purpose and meaning of the events are, and what the ultimate causes for it are. Science can tell us to a degree what is happening, and what something is like, but only theology can provide us with the basis for the discernment of the meaning of a particular event, or with a standard against which to measure values and ethical imperatives.

The representation given in Figure 1 should not be interpreted as indicating some kind of complete and simplistic separation between science and Christian theology, so that scientific interpretation of the world never affects Christian theology, or that interpretation of the Bible and experience never affects science. Scientific descriptions may be influenced by inputs from God's revelation in the Bible, and choices of scientific problems for research and development certainly will be influenced by a scientist's theological convictions. Some theological descriptions are influenced by inputs from God's work in creation that guide us in understanding the majesty of God and in interpreting Bible in terms of relevant physical models.

Science can provide us with information about the things that make up a person and the sociological characteristics of human society, but theology reveals to us the nature of interpersonal relationships and our relationship with God. Science establishes as wide a gap as possible between the observer and the observed, whereas theology deals with the realm of human experience in which we enter into relationships with other persons, making ourselves vulnerable in the process.

Dr. Nasim Butt

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Present Position: Head of Science at King Fahad Academy, London, and Educational Consultant for Science to the Iqra Trust.

Current Research: On the impact of the British science national curriculum for Muslim students and teachers. Also completed his second book (not yet published) entitled *An Exploration of the Limits of Modern Science.*

1. What is your definition of science and religion?

Science has been notoriously difficult to define (twentieth century philosophers of science such as Popper and Kuhn have attempted various definitions based on verification, falsification and paradigm shifts). But a straightforward and workable definition would be that science is a methodical search for knowledge and a deeper level of understanding about the physical and biological world.

Religion is a way of life and a philosophy of life based on the fundamental belief that the universe has a Creator who is intimately aware of its day to day operations and sustains it through His omnipotence and omniscience.

2. Do you see any conflict between your definitions of these two concepts?

None at all. The human mind is capable of investigating the laws which govern the operations of the physical and biological world. There appears to be a deep connection between the human mind and what is happening out there in the cosmos (what we theorise as scientists often turns out to be true upon subsequent experimentation). Science provides the mechanism (physical explanations) and religion the meaning and purpose of human existence.

3. Where do you think there may be a conflict between these two?

Where the concept of religion becomes so narrow that God is progressively eliminated from the universal equation. In deist theology, for example, God created the universe but then retired as He was no longer required to explain previously inexplicable phenomena such as thunder and lightning. Agnosticism and atheism then set in taking science and religion on a collision course (as we have seen in the western world in the nineteenth and twentieth centuries).

4. What have been the grounds for the development of conflict between these two?

To some extent this is answered above. Religion (being holistic) takes more account of science than science does of religion. But if as a result of the developing intellectual atmosphere of scepticism, cynicism, atheism and agnosticism, science is paraded as the new basis for human morality then there is bound to be conflict between the two. As long as some intellectuals in human society maintain that science can ultimately explain everything (the human mind and creation of the universe included), then there will be self-perpetuating conflict as a result of this deeply mistaken intellectual radicalism.

5. What has been the role of religion in the development of science in the West?

The role was positive at one time inspiring scientists like Newton (seventeenth century) in their scientific endeavours. The 'parson naturalist' is a well known occupation of the time, science being used to glorify the Creator. However, relations between institutionalised Christianity and the scientific establishment soured later on. Christianity became an impediment to the development of scientific thought as the Christian Fathers perceived there was too much incongruence between what the scientists were saying and what the holy scripture professed. Biblical literalism now stood on its head.

6. Can we have a religious science?

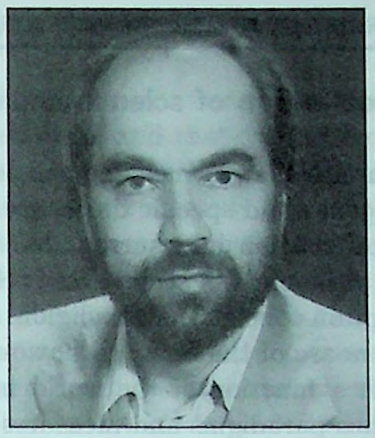
I have already said that religion, being holistic, takes more account of science than science does of religion – so yes. We can use a multimeter to measure the light intensity of a rainbow but we can not (using the same methodology) explain its beauty. A religious science would have a different paradigmatic framework – it would be based on absolute belief in God as the Creator and moment-by-moment Sustainer of the universe, and on our redefined position as His responsible stewards. Such a perception has far-reaching (but constructive) consequences for humanity.

7. Can science dispense with religion?

To a large extent science in the western world has dispensed with religion – the painfully destructive consequences manifesting themselves in the form of environment degradation, excessive commercialisation of science by multinational companies and ill-judged interference in the biological world without adequate forethought of consequences, are there for all to see.

8. Can one separate the domains of activity of science and religion completely?

Again, the western world (blindly followed by much of the Muslim world) has attempted to separate the two domains. But this is an artificial separation, existing in the mind only. There is a fundamental moral vacuum at the heart of western society whose place cannot be filled by science. Religion will always be required to make good this deficiency. Separating the domains results in intellectual anarchy and moral confusion – we are witnesses to such a perversity.



Prof. Reza Davari Ardakani

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Publications: 15 books and more than 100 articles in Philosophy.

1. What is your definition of science and religion?

The question implies that science and religion cannot be defined with proximate genus and specific difference. How could we, who are dependent on religion and surrounded by the world of science, define the perimeters of science and religion? Naturally, we provide a description of science and religion. Some of the contemporary researchers are of the opinion that our understanding and comprehension is a function of the world in which we live, and that this world has paradigms and measures which guide science. I do not mean we do not know science and religion. Understanding is one thing and describing is something else. Of coure, if we are able to describe something, undoubtedly we know it. But, first, we do not know everything through descriptions. Second the highest form of knowledge is about things that cannot be described such as God, truth and justice. But there are people who are aware of God and those are supporters of truth and justice. Any man of religion is familiar with religion. Any man of science is dealing with science. But neither the man of religion nor the man of science know all of religion or science, and, hence, they are unable to define science or religion (and of course, if they are not philosophers, they would not even decide to define science and religion). This difficulty arises more often in the case of religion, because science is related to reason. But reason is not able to understand the depth and mystery of religion, even though religion itself is not alien to reason. It is clear that here we are not referring to science in its wider sense. What is meant here is a science through which the modern world has been distinguished fron other worlds, and its precise example is found in mathematical physics. The positivists viewed this science as expressing constant and necessary relations among the phenomena. In the neo-positivism, it was insisted that science is not a collection of propositions or theories whose correctness is confirmed or proven by experience. The first statement has the added advantage that indirectly it points out to the fact that science had an order. But the second statement is mostly the description of the work that the scientist does. Perhaps Feyerabend had this in mind when he said–and in his opinion one cannot put it any better than this–that science is that which the scientist does. One can find fissures in these so-called definitions. For example,

one can ask whether the constant relations among the phenomena are external relations, and that science recognizes the things and relations as they are, or as Kant used to say, these relations derive their constancy and necessity from the human understanding. If through science one can understand the phenomena of nature, the understanding of each phenomenon depends on our faculty of perception. A phenomenon does not have an independent being. But when some say that science is composed of propostions which are either proved or refuted by experiment they still have not defined science, but have tried to describe the features of a scientific propostition.

However, is it not true that if we know the description and nature of the statements and propositions of a science, then we know that science? But here the question does not revolve around the nature of the problem, but around the way in which the problems are proven or refuted. In effect, it would be as if it were said that science is a collection of propositions which can render themselvest to scientific investigation. Let us assumse that we know the description of scientific propositions. For example, we accept that there are statements and propositions that are proven by experience, and scientific judgments are among these types. In this case, have we found the essence of science? This is not a description of science; it is a brief account of a viewpoint and philosophical perception of science. What should be stressed here is that there is no common feature in the two aforementioned statements. But, how would it be possible then to define, with one or two statements, two things that do not mean the same thing and are not convertible to each other? In the first statement, science or scientific judgment has been described on the basis of its subject matter, whereas in the second description the subject matter and object of science have been completely ignored and the focus has been on the method and form. But a nore difficult question in the second description is: Where does theory come from, and how is it constructed, and if the theory is not derived from exprience, how can experience be the measure for the truth or falsity of scientific judgments? Can science have a measure outside of itself, a measure which would not be in the same category as science? Of course, method is very important in science. It is so important

that oned could say that science is investigation, and investigation is applying a design on beings based on method. As we see in this definition the status of technique in the nature of science has been duly recognized. However, we should not consider it as a definition of science. We cannot define science. There are plenty of ambiguities and differences of opinion regarding the source, conditions, possibilities, exigencies and effects of science, as well as on the relationship between science, history, culture and metaphysics. How can one define science if it doses not have a beginning, and its beginning dates back to man's prehistory, and its end cannot be predicted? Essentially the question about the nature of science is one which belongs to the domain of philosophy and in each philosophy a manifestation of science appears. Hence, it is possible that someone would say that science is the same as quantification, and still someone else might call science [a way of] forecasting. It is possible that some experts would regard science as true because it fulfils our demands and needs. In the language of religion and metaphysics, science is defined in a different manner. For example, it is possible to say that science is among the manifestations of the majesty of the Lord, and, amazes man. Because the path to the Sacred passes through [the realm of] amazement, perhaps through science man can reach the Sacred dimension. The great philosopher of the Islamic world, **Mulla Sadra**, considered science as a manner of existence. He viewed science as possessing analogical gradation. When anyone of us speaks of science, we intend a certain stage of it, and one cannot understand the truth and the stage without referring to the totality. If we are supposed to define particular science, this definition must be with a view to genearl science. Since in the contemporary philosophy of science, universal science is not discussed, it would be difficult and baseless to define science.

Now we must define religion. If science does not have a definition, how can one define religion? Religion is love. It is submission. It is servitude [to God]. It is submission [to the will of God]. It is a covenant. These are all true. But this is still not a definition. If we review, and describe, the religious statements and actions of the man of religion, we still cannot consider it a description of religion. Anthropologists, sociologists, psychologists and philosophers usu-

ally look at religion from outside. Each is trying in a special way to come up with general definitions of religion. It can be summarized, from what has been said in different disciplines that religion is belief in the Sacred, acting on the basis of religious decrees and required rites. But the difficulty is in understanding the meaning of the belief, especially the belief in the Sacred. What is the Sacred? How do we understand the Sacred and the Transcendent and how do we believe in them? For instance, the understanding of the one who sees religion rooted in man's fear is quite different from that of the person who views man as a being who is by nature religious. Before defining religion, we must know what relations there are between man and religion. If man is connected as much with religion as he is with irreligion, and this relation has come about by accident, in effect these are two independent entities, and while man examines religion from the outside, he can understand religion to a degree. But if man's nature is mixed with religion, in that case, in the understanding of religion the believer himself is involved as well; one cannot look at religion divorced from the outside world and in a vacuum. For the moment, I decide against getting involved in these debates. What I want to say is that man became man with the Covenant he made in time immemorial. The beginning of religion starts with the Covenant of the past. Whatever religion encompasses–laws, decrees, its decrees on what is prohibited or permissible, its rites and rituals–are the result of that Covenant. But we have to be careful not to view this Covenant as a covenant between two independent entities. This is a special Covenant. We were asked, while we were only a potentiality, "Am I Not Your Lord?" and we responded positively to the question in the language of our potentiality. With this response we became a human being, and carried the burden of that which has been entrusted to us. The emergence of man, the advent of religion and belief in religion was indeed an event. Man became man after he made a Covnant, and his Covenant was of a religious nature. Some say that if religion had been innate in man then all of the people would have been religious, and no one could have been able to reject religion. These people do not understand that religion is a covenant and it is possible that one would forget or break a covenant, in which case they are covenant-breakers. With this statement, we

have indeed admitted that religion does not belong to us; we have admitted that it is we who belong to religion, and how can a component of an entity define the entity to which it belongs?

2. Do you see any conflict between your definitions of these two concepts?

When providing a description, hardly any conflict arises between religion and science, and if there is a conflict, it is in the subprinciples and conclusions. In fact, there is no conflict between science and religion. No scientist can deny the existence of the sacred source by resorting to science, and view worshipping as a futile act. But sometimes there is a conflict between scientific research and religious absolutes. Earlier thinkers used to say that if a conflict arises between the dictates of reason and the religious decrees, one must interpret the religious decree. This perception, especially in the past two centuries, has led to the interpretation of the religious statements in harmony with the universally accepted scientific facts. For example, some of the researchers and even some of the jurisprudents have adjusted the account of the creation of man to the evolution theory. Perhaps these attempts are not that significant but they are not without justification either. If they view the language of religion and science as one, and if they divide the religious decrees to descriptive and prescriptive decrees, and view its descriptive decrees of the same type as the descriptive scientific propositions and subject to investigation based on the scientific method, they would have no choice but to take the side of science in case there emerges a conflict between science and religion. This is due to the fact that from the beginning they have understood the language of religion as similar to the language of science and have scientifically approached religion, If our yardstick is the language of science and scientific theories, and religious statement has to be interpreted such that it would go along with science, still the language of religion would be different from the language of science: The religious statement, once interpreted, does not mean the same thing as what it seems to say. If it were so, would there be any need for analogy and interpretation? If we look closer, we realize that there is no conflict between science and reli-

gion. Actually, the conflict is between the theologians and scholars or between theology and some parts of the scientific theories or a specific interpretation of these theories. However, in educational textbooks or the like, and in the opinion of those who limit scientific judgments to investigation, research, refutation and proof or testability, and contend that scientific judgments could bed either confirmed or approved, or investigated and refuted, either deliberately or unconsciously, they have created a confrontation between religion and science. Especially when having meaning would mean that it is testable (the view held by most members of the Vienna Circle), one cannont test and investigate a religious decree in the same manner that one would with routine scientific hypotheses and theories (of course, grand scientific theories, too, are not provable or refutable in their totality). The point that needs to be considered here is the meaning of experiment and investigation. If we intend the general meaning of experiment, undoubtedly it would include religious, moral and mystical experiments. Hence, it could no longer be considered a characteristic exclusive to science and scientific research. But the statement that decrees are meaningful only when they can be investigated through scientific methods cannot be supported and the men of science reject such statements. Hence, if someone says that the definition of science is in conflict with the definition of religion, he can hardly justify his own words.

3. Where do you think there may be a conflict between these two?

The way is paved for the emergence of conflict whenever and wherever they want to evaluate religious decrees with scientific measures, and especially view its language of allusion as identical with the quantitative language of sciences. But if the boundaries are clearly recognized, the belief in the religious principles and exigencies would never hinder scientific investigation anywhere. But sometimes some of these dependencies create or destroy the context for doing scientific research. However, whatever is not considered as preconditions for scientific research and does not pave the way for it, is not opposed to science.

4. What have been the grounds for the development of conflict between these two?

In the past periods, there was no contradiction between science and religion. The conflict between reason and religion has been discussed since the time of Plato. From the beginning of the Hellenistic era and Alexandrian period this conflict was intensified somewhat. Muslim philosophers and theologians from the Christian era tried to somehow resolve this conflict. The result of the efforts by Muslim philosophers and researchers such as **Khwaja Nassir-al-Din Tusi** and **Fayyaz Lahiji** is that reason and religion are not at all opposed to each other. If some of the mystics denigrated science, they were referring to a science which serves as a veil.

5. What has been the role of religion in the development of science in the West?

The people of Iran and those in the regions considered the Islamic lands were able to learn the sciences of the Greeks, Chinese and Indians before accepting Islam. But as we know, they did not show any interest or desire [to learn these sciences]. But with the expansion of Islam, the interest in science grew. Seekers of knowledge traveled from remote regions in order to learn sciences. In less than 80 years, sciences such as medicine, astronomy, mathematics, alchemy and philosophy arrived in the world of Islam from India and Greece. Despite the perception common among some historians of science, the sciences of the Islamic era did not have a stillbirth. Rather they were like dynamic newborns who grew to their maturity. But, it would not be appropriate or right to compare the growth and vitality of the sciences of the Islamic era with those of the Renaissance period in Europe.

6. Can we have a religious science?

One understands two things from the term "religious science". One is a science which is about religious questions and discussions. The other is a science which has acquired religious characteristics, even though it is not necessarily connected with religion and is separate from religion. Undoubtedly the second type of science is

intended when it is asked whether it is possible to have religious science. If we approach the issue from an abstract perspective, we realize that logic, mathematics, physics and sociology would not become religious sciences, and there is no need to make them religious, and it is possible to say that speaking of Islamic physics and geometry would be meaningless. These statements, as has been stated before, are generally understood to imply that a person has only engaged in an exercise of futility if he decides to make mechanics and astronomy Christian or Islamic. In whatever world the sciences are, they acquire the characteristics of that world. They also rotate around the axis, as well as serve the interests, of that world. As far as we know, the only non-religious world in the history of man is the modern Western sorld. The non-religious thought and science began in Greece. The Greek world was non-religious and their science, too was non-religious. But if the modern non-religious world would be transformed to a religious world, i.e. this world would vanish and a new world would emerge for which religious thought would serve as the backbone, then science, too, would be under the shade of religion, and would become religious in a sense.

7. Can science dispense with religion?

Apparently science can be independent from religion because the fundamentals of science is not the same as the principles and fundamentals of religion, and scientific judgments are rarely mistaken for religious decrees. Not only the modern science is independent from religion, but also the science of perspectives, astronomy, mathematics and mechanics of the earlier people were not religious and would not have any relations to religiosity. But one could discuss the issue in a different way. One could imagine that if man had not had any religion, would science have evolved to become what it is today? Would science have been possible at all? We do not know what man would have been if there had been no religion. Man became man with the Covenant, and if this Covenant had not been there, man would not have become possessor of science, technique, ethics and politics. It might be said that this statement contradicts what have been considered established facts, because

millennia of growth and development of science in the religious contexts are not comparable with the 200-year or 300-year growth of science in the modern non-religious world. It is true that the modern world is non-religious but this world follows a religious world. In the modern world, pseudo-religious interests have taken the place of religious interests. The existence of this world depends in many ways on religion and religious beliefs. Modern science, too has roots in metaphysis and religious thought. I do not want to dwell on what has been said about the Christian foundation of modern civilization and science. Suffice it to say that if religion had not been there, we would not have known about truth. The dependence of science on truth is of the same type as the religious quest. Actually, science has borrowed the concept of truth from religion and has given it another meaning. Even though science, in its abstract form, is independent from religion, when all the conditions for emergence of science are considered, then we realize that it is connected with religion.

8. Can one separate the domains of activity of science and religion completely?

Based on what has been said in the seventh question, the domains of science and religion are in one sense independent from each other. But if we consider it with a view to unity, both are rooted int the same source.

Prof. Edward B. Davis

Date of Birth: August 5, 1953

Educations: B.S. in Physics from Drexel University, 1975; M.A. in History and Philosophy of Scince, Indiana University (Bloomington), 1981; Ph.D. in History and Philosophy of Science, Indiana University (Bloomington), 1984.

Post-Doctoral Professional Experience: Assistant Professor of Science and History, Messiah College (Grantham, PA), 1985-1990; Associate Professor of Science and History, Messiah College, 1990-1996; Professor of the History of Science, Messiah College, 1996 – Present.

Principal Books: *Robert Boyle, A Free Enquiry into the Vulgarly Received Notion of Nature*, (Editor, with M. Hunter), Cambridge U.P., 1996.

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Principal Books: *Robert Boyle, A Free Enquiry into the Vulgarly Received Notion of Nature*, (Editor, with M. Hunter), Cambridge U.P., 1996.

1. What is your definition of science and religion?

Science is the quest to understand and to control nature (which I view as an order created freely by God). Religion is the quest to understand and to respond to God (whom I view as the creator of nature and the redeemer of humankind).

2. Do you see any conflict between your definitions of these two concepts?

None whatsoever. However, others (who may define science and/or religion differently) may well see conflict.

3. Where do you think there may be a conflict between these two?

As an historian of religion and science, the presence of genuine conflicts at specific times and places in history is obvious to me. This is very far from stating that CONFLICT is in fact the general relation between religion and science. As I like to tell my students with an equation, conflicts $\neq$ CONFLICT, any more than it would be accurate to describe the relation between the United States and Great Britain as one of conflict. The challenge to historians of religion and science is to understand *why* people sometimes differ very deeply over matters that are important to them, and to discover *how* religion and science have influenced one another. The objective historian will find not only some instances of conflict, but also many instances in which religious beliefs have shaped science in very positive ways as well as instances in which science has shaped religious beliefs in positive ways. A further challenge is to communicate this result more forcefully to the scientific community, which has tended to endorse the conflict thesis because it has added to the cultural authority of science.

4. What have been the grounds for the development of conflict between these two?

When specific conflicts occur, they tend to arise either when scientists make unproved metaphysical statements in the name of

science or when religious believers make scientifically false statements for religious reasons.

5. What has been the role of religion in the development of science in the West?

In a word, profound. Monks kept science and other learning alive in Western and Northern Europe during an otherwise very difficult period following collapse of the Roman empire. In the high middle ages, theologians called on scientists openly to acknowledge God's freedom in their scientific theories, which suggested new, non-Aristotelian possibilities that leading scientists explored in fascinating ways. A renewed emphasis on divine freedom in the wake of the Protestant Reformation helped in the acceptance of atomism and positively encouraged scientists like Boyle and Newton to favor empirical approaches to knowledge over rationalistic ones such as those favored by Descartes and Leibniz. And, underlying all Western science are theologically – based assumptions about the unity, comprehensibility, lawlikeness, and value of the universe as the creation of a rational, consistent, and good creator.

6. Can we have a religious science?

This depends very much on how we understand the term. I do not follow those who, like the Nazis, believed that relativity theory had to be rejected as "Jewish science", or those who, like the Stalinists, rejected Mendelian genetics as "bourgeois science". Nor will I follow religious fundamentalists who reject evolution as "evil-ution" and put "scientific creationism" in its place as what they consider "Christian" science. The truthfulness of theories (whether genuine or apparent) is independent of the cultures and beliefs of those persons who create them, even if there are aspects of a culture that were particularly important in the creation of a given theory. On the other hand, I strongly agree that we can identify (and should expect to be able to identify) specifically Jewish, Christian, Islamic, or Marxist *views* of science. For example, though I do not accept the claim that relativity theory is "Jewish science", I think it is valid to speak of one or more "Jewish

views of science", that is, distinctively Jewish ways of relating science to other parts of human life and culture. And likewise for other religious beliefs and political/social philosophies. I am also comfortable with terms such as "Islamic science", when used to refer to the entire scientific enterprise within Islamic culture as a whole. The danger arises when similar terms are used to describe individual theories, usually for ideological purposes.

7. Can science dispense with religion?

Scientists as individual human beings can, and do, dispense with religion – just as other human beings dispense with religion. The decision to lead or not to lead a religious life is an individual one, made by individuals rather than by impersonal entities such as "science". Perhaps the question meant to ask whether scientists are more prone than other persons to dispense with religion. If so, I think the answer is "yes", that scientists are somewhat more prone to dispense with religion (at least with traditional religion) than are most non-scientists. However, some other types of persons, such as journalists, may be even more prone to dispense with religion. And within science, not all types of scientists are equally prone to do so; for example, physical scientists tend to be more religious than biological scientists, who tend to be more religious than social scientists. The reasons for this are unclear, but I suspect that the tendency of certain scientists to live without religion is partly a product of a narrowly technical education, with the feelings of cultural superiority that often accompany it, and partly the product of a general scepticism about all sorts of things that is encouraged by the acceptance of scientists standards of evidence. (Journalists, I note, are no less sceptical about people's beliefs and actions than scientists are about people's truth claims).

On the other hand, historians of religion and science recognize that science itself has actually functioned as religion for quite a few scientists, especially since the late nineteenth century. That is, a number of scientists have looked to the scientific enterprise rather than to religion for hope, mystery, and meaning. For such persons, religion has not been "dispensed with", rather it has been replaced with a different form of religion based on science.

8. Can one separate the domains of activity of science and religion completely?

In principle, yes, but in practice, no. History is replete with examples of religious beliefs functioning as scientific theories and scientific theories functioning as religious beliefs.

Prof. Giuseppe Del Re

Date of Birth: April 4, 1932 (Naples, Italy)

Education: B.A. in Humanities (1949), Liceo Michelangelo, Florence; Ph.D. in Physics (1953), University of Florence; Ph.D. in Chemistry (1957), University of Naples.

Post-Doctoral Professional Experience: Assistant Professor of Chemistry (1954-59), Associate Professor of Physics (1962-69), Professor of Theoretical Chemistry (since 1969), University of Naples; Invited Professor at the Ecole Normale Supérieur en Paris, University of Erlangen, Germany, etc.

Current Areas of Research: Theoretical Chemistry; Foundations of Science and Cultural Status of Science.

Publications: Over 170 scientific papers; Editor of a book on the Brain-Mind Problem, published by the Pontifical Academy of Sciences.

1. What is your definition of science and religion?

Science is the mental and practical activity by which man situates himself in his environment, and tries to satisfy his need to understand what happens in it by

– isolating among his sensations those which appear to be independent of the individual observer, and hence are likely to correspond to features of reality outside him;

– correlating those observations with the help of cause-effect relations;

– establishing general principles and rules which govern all the observed phenomena and their relations. Religion is the response to a fundamental need of man, that of finding an Entity (or possibly entities) which transcends his self and his instinctual drives, and towards which he is responsible for what he does, over and beyond the laws established by society.

2. Do you see any conflict between your definitions of these two concepts?

The two definitions are not in conflict, indeed primitive peoples tend to explain every phenomenon as due to the direct action of God or of lesser spiritual entities. What I believe is that God's will is indispensable for things to be what they are and to change as they do in every single instant; but, since God wants us to collaborate with him by our free choice, he gives us certain tools, the main one being the 'intelligibility' of Nature, which makes science possible. In short: to say that a drop of water falls because of gravity is not in conflict with saying that it falls because it is God's will that it should do so and precisely so.

3. Where do you think there may be a conflict between these two?

A conflict may arise if the very special nature of the human person is ignored, because then one rejects the need for a moral code and *a fortiori* for religion.

4. What have been the grounds for the development of conflict between these two?

Conflicts have arisen for one or more of three reasons:

– one satisfies one's need of God by putting in His place one's own self (often disguised as 'human reason');

– one has a childish idea of God as the Entity whose essential role is to help people in difficult situations; then it is easy to show that science is more effective than prayer, and to claim that there is no God.

– one chooses the easy way, *i.e.* interprets the Books containing the Word of God literally, without taking into account the limits of his personal ability to grasp its depth, and therefore may take apparent contradictions between science and Revelation as proofs against religion or against science.

5. What has been the role of religion in the development of science in the West?

The idea of a personal God who has created the world implied since the beginning of Christianity that the intelligibility of nature is a gift of God and that man's calling includes the search for knowledge and truth. The resulting encouragement to the search for knowledge through observation and reasoning, and the respect for truth regardless of what could please or displease the establishment, created the cultural conditions for the development of modern science.

6. Can we have a religious science?

True science ought to be religious, for nature was created by God, and it is by His benevolence that we are allowed to understand some of its secrets as well as to control or modify some of its operations.

7. Can science dispense with religion?

Science can dispense with religion, but then it quickly becomes a tool of the lust for power or a mere divertissement; in either case

it is no longer primarily the search for truth, and will degenerate until intellectual dishonesty and personal interests destroy its potential for progress. We are witnessing such a process in much contemporary scientific research.

8. Can one separate the domains of activity of science and religion completely?

For the reasons given above, the domains of science and religion cannot and should not be separated. Nevertheless, the danger exists that theologians may impose their *deductive* way of thinking, and forget that honest truth can never be in contradiction with the Word of God. Therefore, as long as it does not interfere with respect for the human person, science should be allowed to proceed independently of religion; and apparent contradictions with the Revelation should be discussed on equal terms and with great humility by theologians and scientists.

Prof. Joseph Emmet Earley, Sr.

Education: B.S. degree in Chemistry, Providence College, Ph.D. in Physical and Inorganic Chemistry, Brown University.

Post-graduate Experience: Research Associate, University of Chicago; Currently Professor of Chemistry, Georgetown University, Washington, D.C.; Chairman of the Chemistry Department (1984-1990), Georgetown University. Visiting associate at the California Institute of Technology; Guest Researcher at the Free University of Brussels; Research Fellow of *The Japan Society of the Promotion of Science.*

Publications: over 70 papers, reviews and chapters on mechanisms of inorganic reactions in solution and also on chemical solutions; over 10 papers and chapters on the relevance of recent developments in science for philosophy and religion.

1. What is your definition of science and religion?

Both science and religion, as I understand the meaning of those terms, are intrinsic parts of human life. Science, broadly understood, is the human effort to understand the world we live in, and how that world functions. Religion, also interpreted in the most general way, is how a particular community celebrates, expresses, and passes on to coming generations, its understanding and appreciation of the past, of the present, and of the future.

2. Do you see any conflict between your definitions of these two concepts?

3. Where do you think there may be a conflict between these two?

4. What have been the grounds for the development of conflict between these two?

There is no *necessary* conflict between science and religion (understood in the broad way that I favor), but in practice such conflict (whether great or small) seems almost unavoidable. Science, by constant probing, questioning, and experimenting, generates knowledge, understanding, and (regrettably but unavoidably) sometimes false opinion. All of these are new – quite different from what has gone before. One of the main functions of religion is to pass on the accumulated wisdom of a people – a profoundly conservative task. That these two great communal undertakings come into conflict from time to time should not surprise anyone.

5. What has been the role of religion in the development of science in the West?

Although modern science may be said to have begun in the seventeenth century, it grew out of a lively philosophical and theological tradition that was closely connected with religion. The habits of mind that made the development of science possible

were formed by religion. The translation of works of Islamic scientists and other scholars (in twelfth centrury Toledo, for instance) ignited the flame of philosophical exploration in the West from which modern science issued. Since that time, many of the most productive men of science have also been religious, and those that were not themselves interested in religion often came from religious families or traditions. Even when active scientists have had no religion, or even been actively anti-religious, the ideas by which they did their science had profoundly religious origins.

6. Can we have a religious science?

There are many questions of deep religious interest that require clarification by science (particularly in the area of the social sciences). Religion may inspire investigations, but guidance by religious authority will generally be disastrous in the conduct of scientific research itself.

7. Can science dispense with religion?

To do science well requires a deep commitment to the "order of Nature" – the idea that, as Whitehead said "at the base of things we do not find mere arbitrary mystery". Science, itself and unaided, has not (yet, at least) shown itself able to engender this attitude where it is lacking (much of the world) or to pass that idea on to future generations. In my view, science is a parasite on religion, or to put the matter more elegantly, science and religion have an obligatory symbiotic relationship. It seems to me that if either of the two should fail (even in a particular community) the other will not survive more than one or two generations.

8. Can one separate the domains of activity of science and religion completely?

Progress in any developed field requires specialization. Clearly we need both scientific and religious specialists. In each of these

two categories there will be many whose main attention is devoted to their speciality with scant attention to the rest of the world. But it is essential that there be many scientific specialists who are well informed in religious matters and (even more importantly) substantial numbers of religious leaders who are well educated in contemporary science. Providing arrangements to achieve this is one of the main challenges facing educators all over the world.

Prof. George F. R. Ellis

Date of Birth: August 11, 1939

Education: B.Sc. in Physics (1960), University of Cape Town; Ph.D. in Applied Mathematics and Theoretical Physics (1964), Cambridge University (St. John's College).

Post-Doctoral Professional Experience: At various times, Visiting Professor, University of Texas (Austin), University of Hamburg, University of Alberta, Max Planck Institute of Astrophysics (Munich); Professor (since 1990), Applied Mathematics Department, University of Cape Town, South Africa; Winner of Gravity Research Foundation Essay Competition 1st Prize (1979); President of the International Society of General Relativity and Gravitation, 1989-1992; Honorary Doctorates, Haverford College (Pennsylvania, USA, 1996) and Natal University (Durban, South Africa, 1998).

Principal Books: *The Large Scale Structure of Space-Time* with S.W. Hawking (1973); *Flat and Curved Space-Time* with R.M. Williams (1988); *Before the Begining* (1993); *The Renaissance of General Relativity and Cosmology* (Edited with A. Lanza and J. Miller, 1993).

1. What is your definition of science and religion?

– Science is the systematic search for understanding of the way the natural world is structured and functions;

– Religion is the search for meaning that underlies the physical world and gives a guide as to how to live.

2. Do you see any conflict between your definitions of these two concepts?

I do not see any no conflict between the definitions of these two concepts; they are concerned with different layers of reality which co-exist in the multi-leveled hierarchical structure of the universe.

3. Where do you think there may be a conflict between these two?

There is a conflict between them in the minds of people who have been misled, or have not looked at the different concepts carefully enough. However this is an apparent rather than real contradiction.

4. What have been the grounds for the development of conflict between these two?

The grounds for development of conflict has been the overzealous attempts from some of those on the religious side to claim for religion territory that is not its to claim, coupled with an arrogance of attitude and proclaimed certainty of knowledge that cannot be supported if one has a solid understanding of the foundations of knowledge. This has been compounded by a demonstrable devastating contradiction between the claimed beliefs of many of the Churches and other religious institutions, and their actual behaviour. The error is to believe that this problematic behaviour of some or indeed of most religious institutions is sufficient to undermine true religion or spirituality, which are not easily mirrored in any human institution.

Curiously the situation is now to some degree reversed: while the vanguard of religious thought is now far more tentative than before, there are quite a few scientists who are presently demon-

strating precisely those characteristics commented on above: arrogance and claiming complete certainty where it is in fact unattainable. They have taken on themselves the mantle of hubris that has been laid down by many religious thinkers.

5. What has been the role of religion in the development of science in the West?

I am not an expert on the role of religion in the development of science in the West, but it is my understanding that the Christian tradition, with its emphasis on the individual, cleared the way for the development of scientific thought.

6. Can we have a religious science?

No, not in the sense I have in mind: because of its nature and its approach to knowledge, science cannot deal with values and issues of meaning that are the concern of religion (and that are fundamental to everyday life). Science is matter-of-fact in its approach to reality; while a scientist may perhaps value the beauty of a rose or regard with awe the images of distant galaxies, in so doing he/she is stepping outside the confines of science itself. The themes it can deal with are measurable quantities such as mass, velocity, distance, force. It cannot cope with purpose.

7. Can science dispense with religion?

It is possible to have science that does so if it is sufficiently narrowly construed. However pursuing science to its limits necessarily raises metaphysical or philosophical issues that science itself cannot answer; and it is in the end incomplete without some approach to these matters, which inevitably to some extent must approach or at least consider religious issues. Furthermore applied science necessarily involves value choices that in the end are based on ethical viewpoints that cannot themselves be based in science. A philosophical or theological basis is needed to ground the ethics that are demanded in order that applied sciences can be coherently applied.

8. Can one separate the domains of activity of science and religion completely?

In view of the above considerations, one cannot completely separate the domains of activity of science and religion. It is also true that science provides the proper setting within which religious faith must be placed: namely our evolutionary origin in a ever-changing universe of vastly greater scale than humanity can easily comprehend, with the behaviour of matter taking place strictly according to the laws of physics that seem universal. This physical situation does not impose on us any philosophical or theological view of ultimate reality, but must be taken seriously by any such view if it is to be viable.

Prof. John Erik Fornæss

Date of Birth: October 14, 1946 (Hamar, Norway)

Education: Cand. Mag. in Mathematics (1967), Cand. Real, M.A. in Mathematics (1970), University of Oslo; Ph.D. in Mathematics (1974), University of Washington, Seattle.

Post-Doctoral Professional Experience: Assistant Professor (1976-78), Associate Professor (1978-82), Professor (1982-91), Princeton University; Professor of Mathematics (since 1991), University of Michigan; Visiting Professor at Several European Universities. Invited lecturer at several European and American Universities.

Awards: Max Planck Award (1990-1993), Germany; Bergman Prize (1994); CEHN Award (1994), France.

8. Can one separate the domains of activity of science and religion completely?

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Awards: Max Planck Award (1990-1993), Germany; Bergman Prize (1994); CEHN Award (1994), France.

1. What is your definition of science and religion?

Science describes the PROPERTIES of the Universe and its parts. Religion deals with the GOALS of the Universe and its parts. Science is reductionist, describing the properties of a composite unit in terms of the properties of its smaller parts. Religion deals with goals of composite units and how they are transferred down to goals of the component parts.

2. Do you see any conflict between your definitions of these two concepts?

There is no conflict between these two concepts. They deal with separate aspects of the same reality.

To say that there is a conflict between science and religion is the same to me as saying there is a conflict between the color of a ball and its weight.

3. Where do you think there may be a conflict between these two?

To carry out the goals for the Universe and its parts, one is limited by the properties of the parts. For example, if one has some goals with the population of a country say, the properties of the population, such as their culture, influences to which extent and how fast those goals can be achieved.

4. What have been the grounds for the development of conflict between these two?

To carry out the goals of religion, the religious hierarchy has imposed certain dogma on the population. Sometimes science has run against these dogma. These dogma comes from people interpreting religious goals.

5. What has been the role of religion in the development of science in the West?

The main role of religion in the development of science in the West has been to occasionally slow it down.

6. Can we have a religious science?

7. Can science dispense with religion?

Science, philosophy and religion provide ways of relating to the Universe and its parts. They describe aspects of the same reality.

Science cannot dispense with religion. Science only provides a bottom up description of the Universe, describing the properties of a unit in terms of the properties of its parts.

To describe how a unit develops one also needs to take into account the top-down influence which is described by religion, i.e. the goals.

8. Can one seperate the domains of activity of science and religion completely?

The goals of religion and the properties of science are both used to describe the same units. To have the best development of these units, one should rather combine these aspects.

One combines these aspects in analyzing the state of units and how this state develops over time. Clever imaginative thinking will take advantage of the properties of the parts in order to move units towards the set goals.

Dr. Peter Fulljames

Postgraduate Experience: Teaching Physics in England, India and Kenya; Teaching Theology in the School of Mission and World Christianity at Selly Oak Colleges, Birmingham; Honorary Lecturer, University of Birmingham; Doing Research on the attitudes of young people towards science and religion.

Publications: Author of *God and Creation in Intercultural Perspective.*

1. What is your definition of science and religion?

The aim of science is to explain natural phenomena in theories tested by observation and experiment. As with all human discourse, scientific theories are to some extent shaped by the cultural context. Religion is a response to the transcendent by which meaning is provided and human lives are transformed. A particular religion is a cultural or multi-cultural tradition of faith and practice, usually including doctrines, narratives, ritual action, spiritual experience, ethical norms and social institutions.

2. Do you see any conflict between your definitions of these two concepts?

No.

3. Where do you think there may be a conflict between these two?

There may be conflict if there is misunderstanding in science or if there is misunderstanding in religion.

4. What have been the grounds for the development of conflict between these two?

I will give two examples that relate to Christianity. The claim that a human being is nothing but the sum total of physical and biological processes in the cells of the body is in conflict with the Christian belief that humans are created for relationship with God. Here there is a misunderstanding of science, for although scientific theories satisfactorily explain many aspects of human life they do not exclude the possibility that other perspectives on human life may also be of value. Furthermore, even when scientific theories are widely accepted they are open to modification as a result of further observation and experiment.

The second example is the conflict between a literal interpretation of the creation narratives in Genesis and evolutionary accounts of the origins of life on earth. Here there is a misunderstanding of religion, for within the Christian tradition there can be new interpretations of biblical narratives in the light of new

knowledge, as long as these interpretations are consistent with the revelation of God in Jesus Christ. The creation narratives are important because they express the faith that all things depend on God and that the created world is essentially good, but the details of the narratives merely reflect ideas about the natural world that were prevalent in the society from which the narratives came. It is to be expected that scientific enquiry will lead to new understanding of the details of the origins of life on earth.

5. What has been the role of religion in the development of science in the West?

Many scientists have been motivated in their work by their religious belief. The Christian doctrines of creation and incarnation have provided support for assumptions that are essential in scientific enquiry: that there is order in the processes of the natural world and that matter is of such value that it is worthy of close attention. Historians have also shown how the development of science in the West has been influenced by Islamic philosophy and science.

6. Can we have a religious science?

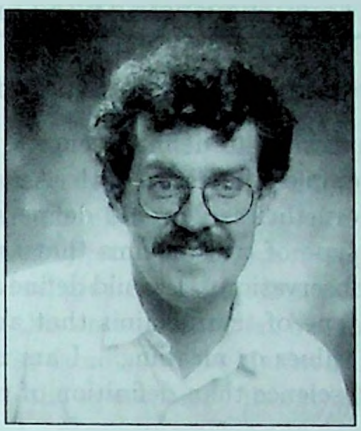
It depends on what is meant by religious science. For Christian, scientific enquiry as any other activity takes place within the framework of meaning provided by Christain doctrines and ethical norms. Yet each scientific discipline has its characteristic methods of enquiry which usually are used by scientists whatever their religious beliefs may be.

7. Can science dispense with religion?

No.

8. Can one separate the domains of activity of science and religion completely?

Science and religion each have their own integrity, yet interaction between the two can be mutually beneficial.



Prof. Karl W. Giberson

Date of Birth: May 13, 1957

Education: M.A. in Physics (1982) and Ph.D. in Physics, (1984) from Rice University (Houston, Texas).

Post-Doctoral Professional Experience: Professor of Physics since 1984; Senior Fellow, Institute for Interdisciplinary Studies; Winner of 1995 Eastern Nazarene College Teaching Excellence Award; Winner 1996 Templeton Foundation Award for Outstanding Course in Science & Religion; Winmer 1998 Oley Zinan Award for best essay in the *Journal of Interdisciplinary Studies*.

Sample Publications: Total of ten papers on lasers and atomic physics; several papers on science-theology interface; a book titled: *Worlds Apart*: *The Unholy War Beetween Science and Religion* (Beacon Hill Press of Kansas City, 1994).

1. What is your definition of science and religion?

I think it is impossible to define science & religion in some clear way that does complete justice to both. Any definition will be open to criticism. Nevertheless, I would define science as "that which deals with the type of truth-claims that are ultimately defended on the basis of observation." I would define religion as "that which deals with the type of truth-claims that are ultimately defended on the basis of values or meaning". I am more comfortable with my definition of science than definition of religion.

2. Do you see any conflict between your definitions of these two concepts?

Yes there is clear conflict because of the impossibility of completely separating observations from value – the fact – value dichotomy that has so long been a part of the Western philosophical conversation. For example, in the Christian Tradition, considerable religious significance is attached to a number of *observations* recorded in the Bible. The *observation* of the parting of the Red Sea, the *observation* of the giving of the 10 Commandments, and the *observation* of the bodily resurrection of Jesus are examples of this. Nevertheless, I would argue that the *primary* religious interest in these historical events is the *value* or the *meaning* attached to them, rather than the events themselves. The Christian Tradition has long recognized the difference between the claim that "Jesus rose from the dead" and "God raised Jesus from the dead". The former is a claim that could, in principle, have been investigated scientifically, while the latter is a faith claim that makes an assertion that goes beyond the observation. In the same way, science has certain values – simplicity, naturalism, symmetry – that guide its investigation of the world of observation. To say that these are not "values" is to miss some of the most useful driving forces in the history of science. Yet they are not "values" in the same strong sense that religion might use the term.

3. Where do you think there may be a conflict between these two?

The notion of conflict is greatly exaggerated. Virtually all of science is so irrelevant to religion that it is hard to find even points of *contact*, much less *conflict*. The famous metaphor of "Warfare" between science and religion is due to our unfortunate enthusiam for controversy. It is this enthusiasm that has made Galileo, Darwin, and John Scopes so famous, while Maxwell, Bohr, and Weismann are known only to the scientifically literate. If you query a typical practicing scientist – chemists working on new house Paints, physicists launching cable TV satellites, biologists figuring out how a hormone works – about the religious implications of their work, they will have nothing to suggest. Conflict emerges in those areas where both science and religion have a vested interest – the origin of the universe, life, and humankind; the basis of human nature; the relationship between humans and animals; etc. But one has only to open a scientific journal to realize that most scientists are not working on these problems.

4. What have been the grounds for the development of conflict between these two?

In most cases the grounds for conflict has had nothing to do with the actual scientific or religious content of the case. For example, the Galileo affair emerged because of certain purely political developments within the 17th century Roman Catholic Church. The heliocentric hypothesis that Galileo embraced and taught was not itself highly problematical; what was problematical was the way that this critically anti-Aristotelian viewpoint undermined some of the historical authority of the Roman Catholic Church. Copernicus' book was placed on the Index in Italy where the political situation was volatile, but not in Spain, where the political situation was much different. Galileo was tried and condemned in Italy at the same time that his ideas were being taught by Catholic missionaries in China. Galileo's infamous trial, which has been the focus of so much attention across the centuries and even today, was not fundamentally a conflict between science and religion. The fact that it is so widely (mis) perceived owes more to the polemi-

cal powers of anti-Christian writers like Voltaire and Diderot, who used it in their propaganda campaign against the Christian church, than to the heliocentric hypothesis which was the nominal focus of the trial. Of course, there are many important places where legitimate conflict has existed and continues to exist. For example, Darwinian evolution cannot really be completely harmonized with the Biblical account of Creation without abandoning some of the key emphases of the Biblical account. Less conservative Christians have made their peace with Darwin by changing the way that they understand the Bible; but many Christians are trying to preserve the Biblical account by attacking or modifying the theory of evolution. The grounds for conflict in this case is simply that the Biblical writers had some wrong ideas about how things originated and science has refuted certain elements of those wrong ideas.

On the other hand, many scientists – Carl Sagan, Richard Dawkins, Stephen Gould, Peter Atkins – seem almost obsessed with extending scientific explanation until it has swallowed up all possiblity of there even being any religious perspective on the world. For example, many religious traditions have long held that universe has a *purpose* – that not everything is due to blind laws and mindless chance. This purpose finds its origin in a transcendent creator who is affirmed as the ultimate origin of all that exists. This religious affirmation has very little scientific content and scientists who affirm it ("We believe that God is the Creator...") generally find that it raises absolutely no problems for their scientific investigation of the world that they believe God created. Nevertheless some very popular and influential scientists are positively evangelistic in their zeal to convince everyone that there is no purpose to anything in nature. This claim goes far beyond what science can claim to have discovered about the world and essentially amounts to a personal religious affirmation that these scientists would like the world to embrace.

5. What has been the role of religion in the development of science in the West?

Religion has played a number of roles. During the first millennium, while Western Civilization and culture were disintegrating,

scholarship and learning in the West were kept alive in the service of the church. The brilliant and creative thinking that emerged during the Renaissance was only possible because (1) The church had maintained a high level of literacy and intellectual sophistication among its leadership; and (2) Greek culture, especially Greek science, had flourished in the Islamic world, from where it was "imported" to the West. If the church had allowed its religious culture to disappear along with the rest of the Western tradition there might not have been a Renaissance.

There are also a number of intriguing possible connections between the Christian Tradition and the birth of science during the scientific revolution. Christian Theology has long taught that: (1) Nature was rational and orderly, being the creation of a single rational God. This implied that nature was de-animated – not filled with numerous "spirits" that would make it unpredicatable, irregular, and not amenable to scientific investigation. (2) The rational order of nature was reflected in the rational powers of humankind, who had been created in the "image" of the Creator. It was thus conceivable that the human intellect might be able to discover the patterns on which the Creation had been built. (3) There were resources in nature that could be used in the ministry of the church. This practical concern motivated many church leaders to study medicine, for example. (4) The discovery of the patterns in nature was a legitimate act of worship, a way of praising the Creator. These four motivations, in varying degrees, certainly played a role in the thinking of those scientists responsible for the scientific revolution. Whether or not this role was *essential* is difficult to determine. Certainly, these beliefs are not *sufficient* for science, or science would have emerged a thousand years earlier. But, it can be argued that one or more of these beliefs may very well be *necessary* for science. During the first millennium, while Western culture and Greek science were disintegrating, science was flourishing in the Islamic community – where a similar "Theology of Creation" was influential.

Scholars might never agree on the extent to which science owes its origins to religion but a strong case can be made that the Judeo-Christian theological perspective on creation played a substantial, perhaps central, and possibly even necessary role in the emergence of modern science.

6. Can we have a religious science?

If by a religious science, we mean a science where the appropriate religious meaning is attached to scientific theories then I doubt that we can have a religious science. Science is successful largely because it does not address the "big" questions that have long been the concern of religion – Where did everything come from? Why is there something rather than nothing? What is the purpose of human existence? Are there other "realities" beyond this present world? It is hard to imagine exactly how science could even begin to *think* about these difficult questions, must less answer them. Science seems smart largely because it attempts to answer only the easy questions. If you asked me, in my role as a scientist, how to determine whether or not the human personality survives death, or what is the purpose of gravity, I would have no idea how to even begin thinking about the question.

On the other hand, if by a religious science we mean a science appropriately humbled and open to the insights of religion then I think such a science may be on the horizon. It is one of the characteristics of our "post modern" age that knowledge is becoming de-compartmentalized and questions of meaning are being joined once again to questions of fact. Out of this union may come a religious science in which holistic explanations containing both matters of fact and value begin to emerge. But I think it will always be possible to distinguish the religious from the scientific portion of the explanation.

7. Can science dispense with religion?

Certainly most scientific activity takes place without religion. This is not. however, because science has dispensed with religion, but rather because religious considerations are simple not explicitly relevant. What, for example, has religion to say about continental drift? But, science is a big enterprise and its boundaries have always been difficult to locate, and have even moved historically as religious type questions became scientifically investigable. The practice of science always results in the emergence of new questions and these questions are sometimes at, or beyond, the currently accepted boundary of science. Current cosmological speculations

about the possible absence of a true temporal "beginning" to the universe are certainly straddling the boundaries of science and raising religous questions. As long as science has a "cutting edge" it will, no doubt, find itself in intersection with religion.

And we must keep in mind that science is done by scientists and that, as human beings scientists are often religious in nature. It is entirely appropriate to ask a scientist what was the *purpose* that he or she had in mind when they wrote their book arguing that there is no purpose in the world. Or why they do science in the first place. Or how they decided to go into biomedical research. Or why they think that certain types of DNA research should be prevented.

8. Can one separate the domains of activity of science and religion completely?

No, not completely, but we must take care not to be so distracted by controversies that arise in the ambiguous and troubled borderland between science and religion that we fail to notice the huge peaceful communities that do not live near that border. It is instructive to pick up a theological text and try to identify those portions of interest to science. There are not many. In the same way, it is hard to find topics of religious interest in a science text.

Prof. Andrei Grib

Date of Birth: 1939 (Russia)

Post-Doctoral Professional Experience, Chief of A.A. Friedmann Laboratory of Theoretical Physics; Head of Department of Mathematics, St. Petersburg University EF (St. Petersburg, Russia).

Current Areas of Research: Elementary Particle Physics and Cosmology; Modern Physics and Orthodox Christian Theology.

Publications: over 110 Scientific Papers and 5 Books on Elementary Particles, Big bang, Properties of Quantum Vacuum and the Problem of Measurement in Quantum Physics.

1. What is your definition of science and religion?

Science is getting systematic, step by step, knowledge of the surrounding world and of the human being.

Religion is getting knowledge of contacts with superhuman, transcendental to human being.

2. Do you see any conflict between your definitions of these two concepts?

I see no conflict between my definitions of these two concepts.

3. Where do you think there may be a conflict between these two?

A conflict between these two may be if science will neglect existence of superhuman, transcendent to human being, or if religion will praise as superhuman, transcedent, objects which in reality can be explained by science.

4. What have been the grounds for the development of conflict between these two?

The grounds for the development of conflict are in erroneous "deification of science" or in "idolatry-creating" in religion.

5. What has been the role of religion in the development of science in the West?

Religion as concentration on Ultimate Truth always played important role for the development of science in the West, where due to Judeo-Christian tradition the universe was always considered as different from God and immanent to man and woman investigation. "Be perfect as your Father is" means for Christians, that if our Father "knows" what is inside "supernovas", etc, we must also know it ... .

6. Can we have a religious science?

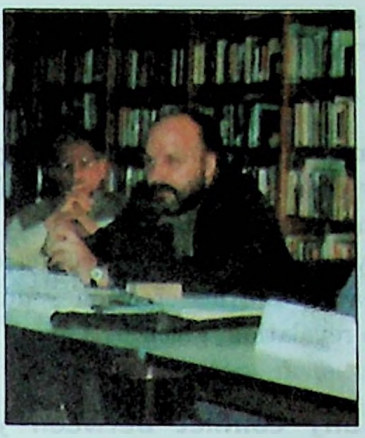
Honest science is religious science.

7. Can science dispense with religion?

Science and religion are necessary one to the other, but they can't mix.

8. Can one separate the domains of activity of science and religion completely?

One can't separate the domains of activity of science and religion, because the frontier between transcendental and immanent can't be defined by a human being and one must expect intersections between them, fruitful for the development of both.



Dr. Sergei Grib

Date of Birth: June 10, 1944 (Saint Petersburg, Russia)

Education: A-level, English Grammar School, 1961; State University of Lenin- grad, Faculty of Mathematics and Mechanics, 1961-66; Ph.D. in Physics and Mathematics, Leningrad State University, 1972.

Post-Doctoral Professional Experince: Lecturer of Mathematics at the Technical University of Leningrad, 1984-85; Visiting Professor of Space Magnetohydrodynamics, Florence University, Italy, 1990, Associate Professor at the Faculty of Applical Mathematics, Leningrad State University, 1988-89. Astrophysical Department, Academy of Sciences, since 1989; Superviser of the Solar Research Theme, since 1994.

Current Areas of Research: MHD Theory of The Solar Corona; Solar wind and Heliosphere; Geophysics and Gasdynamics.

Publications: over 87 scinentific papers and communications, 15 papers on Religious Philosophy.

1. What is your definition of science and religion?

Science is dealing with nature with the help of logics and instruments made by man. It is concerned with the creation and it studies the natural revelation.

Alternatively, religion is the reflection of the connection between God, creator, and his creation – human beings. It deals with the Divine revelation, given by God.

2. Do you see any conflict between your definitions of these two concepts?

There is no conflict between these two definitions.

3. Where do you think there may be a conflict between these two?

A conflict may appear when the boundary between science and religion is forgotten (as was the case in ancient Europe, in Nazi Germany and in Soviet Union).

4. What have been the grounds for the development of conflict between these two?

The grounds for the development of a conflict between them may exist among ignorant and fanatic people who are making idols either from religion or science.

5. What has been the role of religion in the development of science in the West?

The role of religion (or better to say of clergy) in the development of science in the West was sometimes helpful and sometimes hindering.

6. Can we have a religious science?

I think we can't have the religious science, because religion is accepted freely, unlike science.

7. Can science dispense with religion?

Science can't dispense with religion, because science is being made by human beings who cannot forget about religion.

8. Can one separate the domains of activity of science and religion completely?

It is impossible to separate the domains of activity of science and religion completely, though there is a definite boundary between these two.

It is as if religion is dealing with the third (vertical) dimension, where as science is studying the properties of objects lying on a two-dimansions surface.

Ayatollah Hassan Hassan-Zadeh Amoli *

Date of Birth: 1928 (Amol, Iran)

Education: Preliminary education in Amol; studied with Ayatollah Ahmad Lavasani, Ayatollah Muhammad Taqi Amoli, Ayatollah Abul-Hassan Sha'rani, Ayatollah Abul-Hassan Qazwini, Ayatollah Ilahi Qumshe'i, Muhammad Hussein Fazil Tuni, Ayatollah Mirza Ahmad Ashtiyani, Ayatollah Muhammad Hossein Tabatabaei.

Research Interest: Philasophy, Theology, Gnosis, Jurisprudence, Quranic Exegesis, Poetry, Traditional Medicine and Traditional Mathematics and Astronomy. He is one of the very few living authorities in Islamic Studies, especially Islamic Philosophy and Gnosis, in the present-day Iran.

Publications: He is a Prolific author and has more than 70 books and treatises in Persian and Arabic to his credit.

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* Ayatollah Hassan-Zadeh Amoli's presentation was in Persian. It was translated into English by Professor Gholam-Reza A'awani. We thank Prof. A'awani for his contribution.

1. What is your definition of science and religion?

Science, in the real sense of the word, is true knowledge of the author of the book of existence and the ontological words contained in this book, as far as it is possible for human beings. Knowledge in itself, is a kind of luminous being and an actuality, free from potentiality and materiality. Man perfects, himself and ascends the ladder of existence and adds actuality to actuality by realizing in himself this light until in the end he becomes a luminous being. As the famous Persian poet, **Manouchehrī Dāmaghānī** has eloquently said:

It is like a half-lit dying-out lantern
Whose oil increases hour by hour

Since knowledge and action are the two substances making the reality of man, in whom both as knower and as actor, the two substances are unified, in the "divine science", it is well said that "man through learning wisdom – which is none other than the acquisition of knowledge and due action – becomes an intelligible world like unto the objective world of reality".

True science is the eye by which the rational soul of man preceives reality and by whose light discriminates between truth and error, and attains to the eternal bliss, wherefore the Messenger of God, Muḥammad the last among prophets – upon whom be the blessings and the benedictions of God – has said:

"*science is the guide of action.*"

Religion, however, can be defined as the true discipline and the real injuctions which safeguard the humanity of man and guide him to felicity and eternal happiness. All the rules and texts of religion are in accord with the sacred science and are, in the true sense of the word, real. Hence only God, the creator and the author of human beings is alone capable of compiling such a discipline. The same pen and the same hand which have written this Cosmological Book and have existentiated this inconceivalely great and majestic order with unsurpassable beauty in which each ontological word has its proper function and in which there is not the least iota of deviation, discrepancy, inadequancy and disorder, the same pen has foreseen and provided for the needs of His grand

creature called man, with sheer wisdom, so as to lead him to his ultimate goal and final perfection. Such a discipline foreordained by the absolute wisdom of God, we call religion.

It is most proper here to present to our dear readers a precious gem from the utterances of the Messenger of God, who said:

> "*Verily this Holy Quran is the banquet of God, so learn the manners of this banquet as far as you can.*"

The Holy Quran has been revealed in order to cultivate the spirit of man and to rectify him. So the above utterance of the Holy Prophet means that the Holy Quran is the book of divine discipline and decorum by which man safeguards his humanity and by a right and righteous upbringing realizes his Divine nature. So the above statement means that the Holy Quran is the handbook of Divine decorum and the command of God: learn decorum from this Divine Book and keep to the limits of your humanity and by following the Divine commands, rectify yourselves and realize in yourselves the God-given potentialities. Again the Holy Prophet said: "My Lord has taken upon himself my refinement and how well He has refined me". Again he is reported to have said: "My Lord cultivated in me the noblest moral qualities".

2. Do you see any conflict between your definitions of these two concepts?

Science, in general, and Divine science in particular, is like a beam of light which is identical with the reality of him who possesses that science and illuminatates his being and enables him to see the path ahead. Sages have rightly said that science and the possessor of it are not two things but the one is identical with the other. The Holy Prophet – upon whom be the benedictions of God – said: "Science is identical with the intellect, and the spirit of them both is right understanding". Religion always induces one to acquire such a luminous knowledge and considers one's rank in the hierarchy of being and perfection to be the same as his rank in knowledge; because no religious injunction is conceivable without rational justification, wisdom and some kind of benefit for the ideal human commonwealth on the one hand and the perfection and felicity of the

individual human being on the other. Most experts in the science of religion have written monographs on the mysteries of the religious injunctions such as "The mysteries of prayer", "The mysteries of fasting", "The mysteries of the Holy Pilgrimage" and so on.

In the Holy Quran, the last among the divine scriptures we read: "These parables we cite for common people, but none save the people of science comprehened them". In this verse "the people of science" are distinguished and set against the "common people". The "common people" is a reference to the "multitude" and the "rabble of mankind" and "the people of science" is a reference to those who have attained to the peak of absolute science; they are those who possess the intelligence and are able to intelligize the nature of things. This means that parables have both a shell and a kernel. The shell is meant for the common people who are not well-trained in the intellectual and scientific discipline and are not able to fathom the Divine mysteries. The kernel is meant for the "people of science" who through intellectual training and scientific discipline are able to penetrate from the outward to the inner reality of things. Molavī, the famous Persian poet, referring to the above Quranic verse, says:

O brother, the parable is as a corn measure
In which the meaning is hidden as grains
Seize the grain of meaning, O man of intelligence
Do not heed the measure if it changes into another

The last of Messengers, Prophet Muhammad, upon whom be the blessings of God, in the following tradition has considered paradise to be the real wisdom: "I am the city of wisdom–which is the paradise–and you are–O Ali–its gate". In summary, science and religion not only are not in conflict, but being of the same substance and origin, corrobrate each other.

3. Where do you think there may be a conflict between these two?

It is possible that a certain science which is of no avail, neither in the context of human life and civilization, nor of any significance in the knowledge of the mysteries of religion and which might cause the perdition of mankind or harm his eternal bliss, be rejected

by divine religion, as are certain kinds of food and drink like eating carrion, and drinking intoxicants which are prolibited in the Islamic Law.

4. What have been the grounds for the development of conflict between these two?

This question can be answered from two points of view.

The first view-point is somewhat similar to our answer to the question number 3.

The second aspect of the question is that in the past a certain group of people known in the traditional sources as *Aṣḥāb al-ma'arif* "people of learning" believed wrongly that there is no need for revelation, prophecy and the Divine Law. They argued that the statements of the claimer to prophecy were either in accord with reason or not. If they were in conflict with the grounds of reason, they could not be accepted and if the tenets of faith and revelatian were in accord with the exigencies of reason, so they would be superfluous and redundant, reason being the supreme judge and arbitor: so they argued that there is no need at all for prophecy and revelation.

But such a way of reasoning is in fact erroneous and extermely weak. It is only a pretext for shirking one's responsibilities, for human reason as such is incapable of comprehending the true essence of things which is necessary for positing laws which would ensure man's happiness. Only the inner logic of revelation can undertake legislature for man. Of course after the appearance of a divine revelation we come to know about the mysteries hidden in it, which could not be known prior to revelation. This problem is discussed in minute details in theological texts.

Here it must be pointed out that the term "people of learning" is not used here in a literal, technical sense, but on the contrary it was adapted in the Traditional sources to refer to a special group of people who denied the institution of revelation and prophecy, and who believed that reason was autonomous in discovering and interpreting the laws related to this life and the hereafter. The famous exegete of the Quran, Tabrīsī in his *Majma'al-Bayān* while commenting verse 103 of the second chapter: "and if they believed

and feared God, a recompense from God would be better for them, if only they knew", says:

> *"In this verse, there is a manifest refutation of the opinion of the "people of learning" because God, the Almighty, denied them such knowledge".*

5. What has been the role of religion in the development of science in the Islamic civilization and in the West?

There is no doubt that the emergence of the great civilization of Islam had a great impact upon the progress of science, with all its ramifications, in the Western civilization. This is a point which cannot be denied by any scholar well-versed in the subject. Many books and articles have been written in this regard of which I quote two passages. The first one is by Alfred Guillaume in his introduction to the book *Heritage of Islam* compiled by thirteen famous Islamologists, published by the Oxford University Press and translated into Persian by Muṣṭafā Alam and Sa'aīd Nafīsy. He says:

> *"The Heritage of Islam seeks those European scientific, industrial, cultural and spiritual factors which are taken from the Islamic world and derived the from Eastern Arab Lands ··· . It is Islam and the grand Islamic Empire have which combined the sciences and crafts of various lands and have introduced them perfectly and beautifully to the world of science and industry".*

There are several other sincere remarks by the same authors in the mentioned book.

The second book is entitled *The Islamic Sciences and Their Impact on the World Scientific Evolution* translated into Persian by Messrs. Muḥammad Reẓā Raẓavī and Asadullāh Alavī and published by Āstān Quds Research Foundation. Moreover many other books and articles, such as those mentioned above were written by those who were both experts of science and adepts of contemplation and spiritual realization. I would like, to quote, as an

example, a few lines from "The Impact of Quran on the Rise of the Islamic Civilization" written by my beloved master, the late **'Allāmah Sha'arānī**, May God have mercy on him!

"Those who have studied history and are well aware of the story of the ancient civilizations know well that until the rise of the Greek civilization, no nation reached the high peaks of science among the ancients and no nation was as able to attain the acme of culture and civilization. Those, moreover, who were before the Greeks were lower than them in rank in this regard. A short while before Alexander the Great philosophers and scientists proliferated and there appeared among them such great luminaries as Plato and Aristotle. After the world conquests and the hegemony of Alexander the Great, Greek science and language disseminated in the Hellenized world, such that they became world-wide for a thousand years and Greek became the language of both science and religion. Even the followers of Jesus Christ wrote the Gospels in Greek. The word Injīl (Evangels) in Arabic, itself is derived from the Greek word ***Euangelion*** *meaning the good tidings. This, notwithstanding the fact that Jesus Christ was not Greek, nor did he belong to the Hellenic or Hellenistic culture, since he spoke the Aramaic which is an offshoot of the Hebrew language.*

Almost a thousand years after Alexander the Great; there appeared ***Muḥammad ibn Abdullāh****, the last among the cycle of prophets, upon whom be the blessings and the benedictions of God. The Holy Quran was revealed to him in Arabic and henceforward Arabic superseded Greek as the language of science and even surpassed it in scope. Muslims adopted the Greek sciences. In their hands the sciences proliferated and multiplied as much as many times. Arabic for many centruries became the language of science and achieved a high status and sciences were written in this language which had never been written in any other language before.*

In history books it is recorded that the library of Alexandria in Egypt which was one of the largest libraries in the ancient world contained only 25,000 books in Greek sciences, but in the Islamic era, the number of books in Islamic sciences in huge libraries outnumbered a million.

Jorjī Zaydān*, in his* ***History of Islamic Civilization*** *and also in his* ***History of Arabic Literature*** *says that, two Fatimid*

caliphs of Egypt called Aziz billah (365-386 A.H.) and Hākim bi Amrillāh (386-411 A.H.) set up libraries in Egypt, which shelved over one million books, that is forty times as many as the books of the Greek library of Alexandria. Again he remarks that there were many great libraries in Egypt, Iraq, and Andalusia (Islamic Spain), each containing hundred thousands of books and they were all open to the public. So we can surmise that the books written in Arabic science were at least forty times as many as those written in Greek.

Greeks, no doubt had compiled books in literature, ethics, rhetoric, the science of law and jurisprudence, politics, history and geography, but without doubt, from the point of view of quantity, quality, depth and precision of research, they were not comparable to those written in Arabic. In mathematics, particularly in arithmetic, algebra, trigonometry, algorithm and astronomy, Muslims far surpassed the Greeks. These accomplishment were all due to the blessings of the Holy Quran. What we say is not an exaggeration and the history of science is our best witness.

*Since in the Holy Quran, Muslims were enjoined to perform their ritual prayers five times a day, they had to acquire the knowledge of the time and the direction of the prayer, so in order to determine the precise direction of Mecca (**qiblah**) and also the times of the prayers, they were in urgent need of the science of astronomy, which again obliged them to learn the other branches of mathematics. The laws of inheritance and the distribution of shares among legal heirs is a very complicated affair in Islamic Junisprudence and made Muslims to learn advanced arithmetic. In order to determine the rate of the alms-tax and taxation duties and to calculate the areas of their lands, they again needed arithmetic. Engagement in Holy wars and performing the Holy pilgrimage, taught Muslims the science of seafaring and exploration and they came to know about the circumstances of other nations and countries and so they started to compile works on geography and so on.*

Islam has emphatically prohibited Muslims from imitating their forefathers and ancestors and has invited all believers to true faith through rational investigation and has made knowledge about the articles of faith by means of rational analysis incumbent on all Muslims. The opponents of Islam and the detractors of religion

were in constant debate with the Muslims who had to refute their opponents on the basis of argumentation and rational demonstration. Hence they came to discover the philosophical veiws of Greek philosophers and the sages of other nations, from whom they learned the science of logic and the art and methods of reasoning. So, on a careful analysis one can see that Muslims learned all these sciences in the light and through the blessings of the Holy Quran. ··· Thus we can conclude that the Modern Western science and civilization are the continuation and protraction of Islamic sciences, rather than being derived from Christianity".

This was a summarized account of the words of my master, the late **'Allāmah Sha'arānī** – May God illuminate his proofs – taken from his book *The Path of Happiness.*

6. Can we have a religious science?

The question as I understand it is as follows: Are human beings as such able, by themselves to unveil the mysteries of the Divine laws and the injuctions of the Divine religions or not.

Answering this question we say: As the Great book of Existence – that is the ontological order – is laid on the foundation of knowledge and wisdom, as the very word **'Ālam** (the world) in Arabic signifies, being derived from the root **'Ilm** (Knowledge) and so meaning the piled-up knowledge, so also the Holy Written Scripture, i.e. the Holy Quran is similar to the Book of Existence, that is, it is mere knowledge and sheer truth and wisdom.

For instance all the obligatory rules in religion are to the benefit and advantage of believers and all the prohibitions on the contrary are to their deteriment and disadvantage. All the rules of religion as recorded in the books of Islamic jurisprudence, beginning with the book of purification and ending with the book of indemnity and blood-money are based on rational causes, and justifications.

The Islamic law, for example has not prohibited the eating of the sour grapes and its juice, grapes, grape juice, vinegar and raisins, but has prohibited the drinking of wine, because of the evils and harms which it incurs. In the Holy Quran we read: "O believers, wine and arrow-shuffing for idols and divining-arrows are filthy and abominable and part of Satan's work, so avoid them

so that you may be saved. Satan only desires to precipitate enmity and hatred among you in regard to wine and arrow-shuffing and to deter you from the remembrance of God and from prayer, so will you not desist?" (Quran, chapter 5, verses 93 and 94).

Our compendia of Holy Traditions which are among the best of our spiritual heritage handed down to us from the Household of Revelation and Inerrancy and which are in reality the best commentary ever written on the Holy Quran based on the highest spirtual realization, reveal to us many mysteries and secrets of the Divine laws, injunctions and prohibitions and contain many allusions which are the stock-in-trade of any searcher after truth. Among such books one can mention *'Ilal ash-Sharā'i'īye* (The Justificatory Causes of the Divine Laws) and *Ma'ānī al-Akhbār* (the Meaning of the Holy Traditions) compiled by the eminent Shiite scholar Sheikh Ṣadouq, the latter book containing 426 chapters, from which I quote one or two examples:

The first Shiite Imam, The commander of the faithful, **'Alī ibn Abī Ṭālīb**, expounding on of the mysteries of the Book of Existence is reported to have said: "There is no living creature with non-protruding (hidden) ears, except that it is oviparous (egg-laying) and no one with protruding ears (literally apparent) except that it is viviparous (i.e. bears children).

So snakes, lizards, fish, eels and turtles and most of the birds whose ears are not protruding and have no auricles are oviparous that is, they produce their young by hatching, whereas human beings, deer, horses, lions and bats, with protuberant ears and auricles bear children.

Let me here mention a noble lady who was both a writer and great scholar, with an admirable single-mindedness and talent who made some research about this matter. The learned Qajar prince **Farhād Mīrzā** in his distinguished book *Zanbīl* says:

> *"Amir Kamāl-ad-Din Hossein Fanā'i is reported to have said: The sixth Shiite Imam Ja'afar as-Ṣādīq one day asked the lady Umm-i-Jabir as to what she was doing. She answered that she was busy finding out among the living creatures which ones laid eggs and which ones gave birth. He said that would not need much thinking because those with prominent ears procreate and*

those otherwise lay eggs "That is the ordaining of the Almighty, the All-Knowing." (Quran, 6:96). So hawks which are birds with non-protuberant ears lay eggs; the turtle which is a grazing animal with the same qualifications again lays eggs but the bat which is a bird with protuberant ears begets".

It must be pointed out that Avicenna in the first article of *De Animalium Partibus* of his book *Shīfā* (Translated into Latin as *Sufficientia*) in the beginning of chapter five says:

"*Among the bipeds only human beings procreate*"

He means that all bipeds except human beings lay eggs. We should add here that Avicenna's statement is not quite correct as bats and vampires, which are bipeds procreate rather than lay eggs. However our quotation from Imam **Ja'afar as-Ṣādīq** is completety and perfectly correct.

What we said, was only an example of the mysteries of the Book of Existence. Let us return to another example, this time chosen from the mysteries of religious laws. One of the Inerrant Imams was once asked: "If one finds an egg in the woods, how does one know whether it is ritually lawful to eat that egg or not." Where-upon the Imam answered: "every egg with two identical even ends is ritually unclean and eating it is probibited, but if only one side is even as in the egg of a hen, it is ritually clean and eating it is commendable.

Fayḍ Kāshānī, the famous Shiite scholar, traditionist and jurisprudent quotes several traditions regarding this issue in the eleventh chapter of his *Wāfī* (Rahli edition, vol. 3. p. 15)

A snake-egg, for example, is oblong and its two sides are equally even. The egg of a tortoise is round and so equally even from every side and hence both of them are ritually unlawful to eat. The eggs of partridges, doves, sparrows and hens, on the other hand, are conic in shape, one side being even and the other side elongated and hence ritually clean to eat.

Food-discriminating and ritually-clean-eating birds have wholly conical eggs. Some ritually clean birds, such as ducks, eat slime and worms, so their eggs, even if conic in shape, are not as perfectly conical as the food-discriminating birds.

So in answer to your question "Is such a thing as religious science possible?" I would briefly say that even if there has been much wrangling concerning such problems in Islamic Jurisprudence, but it is an indisputable fact that all religious laws are based upon cosmo-ontological causes which are alluded to in our compendia of Holy Traditions. And also in the books written by our religious scholars, many mysteries of the Divine law are divulged, most of which are commendable and which can be used as guideposts for further inquiry. So religion has never been a hindrance on the way of scientific investigation and research, but on the contrary it has always encouraged and persuaded believers to pursue this enterprise. For example in Turayhi's *Majm'a-al-Bahrain*, under the Arabic root-stem far' (فرع) the following Holy Tradition is quoted from.

Imam **Muḥammad Baqir** and Imam **Ja'afar as-Ṣādīq**, the fifth and the sixth Shite Imams: "It is incumbent on us to insinuate to you the principles and it is incumbent on you to deduce the ramifications."

In the authentic Islamic mystical writings such as **Mīṣbaḥ-al-uns** by **al-Fanārī** it is explicitly stated that the Injunctions of the Divine law all derive from the ontological context of realiy. In the beautiful words of **Avicenna** in *Dānesh Nāmeh 'Alā'ī* "To each and every thing unknown there is a path through which it becomes known."

7. Can science dispense with religion?

Certain sciences such as those concerned with crafts and professions and connected with the comfort and the welfare of human life are, so to say, independent of religions, unless they are taken into consideration from the point of view of ritual purity or impurity, licitness or illicitness, or with respeet to the intentions and aims for which they are performed. In any case the Holy Quran is the basis for the perfection and the eternal happiness of human life; it preserves the humanity of man and safeguards his eternal bliss. Therefore man, whatever his social status or profession, is in need of it and cannot dispense with it.

8. Can one separate the domains of activity of science and religion completely?

As explained in our answer to the question number one, the luminous religion of Islam is in accord with sheer knowledge and is the Right Path. The Holy Quran is the logic of God and also the last word of God. Its other name is Furqan which means "that which distinguishes truth from error". A perfect savant in religion is one who knows perfectly well all the sciences which in one way or another are related to religion as is witnessed and well testified by the life and works of the great scholars of religion. The sciences which are essential for the scholars of religion to know are well indicated in their works.

Islam is not opposed to the sciences and crafts which cause the advancement of the perfect human social and political life and improve his welfare and means of livelihood but supports and encounages them. **Farabi's** *al-Madīnah al-Fāḍilah* and the other works written by Muslim sages are the best evidence for the matter. Even to talk about the separation of religion and science is a vain idea and an idle talk.

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SCIENCE AND RELIGION

From the earliest times men and women have looked at the stars and wondered what is the purpose of it all. That question is still with us today. Generation follows generation, and most of us are soon forgotten. We are brief leaves of the flame of life, received from our parents and passed on to our children. When we die, is that the end? If so, why did we struggle and suffer? If not, then what lies beyond death, and does it depend on the way we have lived our lives? Sometimes we are pleased with our actions and feel good, and at other times we regret what we have done, and feel remorse. Is this just the result of social conditioning, or are there some standards of right and wrong to which we must conform? If so, how do we know what is right and what is wrong? Should we just look after our own interests and those of our family? How extensive is our family? Is it just our nearest blood relations or does it also include our tribe, our village, our town, our country or all mankind? Does it extend to future generations? Is it right for us to live well, while others are starving? What about the animals, the plants, the land and the sea? Can we use them to satisfy our needs and our pleasures, or do they also have rights?

In primitive societies most men and women were preoccupied with the struggle to survive, and had little time to spend on such questions. Some exceptional individuals, however, were more concerned than others, and gradually they were set apart and given the duty to try to find an explanation of it all, to find a story that would make sense of life. They were the shamans, the first priests. They knew that we do not control our lives. We do not make our children, nor do we control the forces of nature. Things cannot just happen: there must be some force or person in control, some great spirit. Perhaps there are lesser spirits that control the forces of nature, the spirits of the sea, the forests and the mountains. If there are such spirits, who can make or break us, then we must try to please them so that they will bring rain to make our crops grow, and sunshine to ripen them, so that we have a good harvest. How can we placate these gods, and how do we know if we have satisfied them? Is thunder an expression of their anger, and sunshine of their pleasure?

The shamans thought about these questions and developed elaborate stories to answer them. They performed rituals to please the gods and ensure success in life. They laid down and enforced codes of belief, and

thus came to exert great powers over life and death.

The shamans were also repositories of knowledge about the natural world. They knew the properties of plants and the ways of animals, when to plant and when to reap. At a primitive level, they were the world's first scientists.

With the growth of civilisation and the increasing complexity of life, the roles of the priest and the scientists diverged, until it became no longer possible for them to be combined in the same person. Now they are seen to be highly specialised and separate activities. If however they are separate, can they interact with each other in any way, and if not, then how are they related?

Religion remains what it has always been, a set of beliefs that provides a framework for our lives, answers the fundamental questions about the meaning of life and death, sin and forgiveness, and provides a system of rules that should guide our lives. There have been many answers to the fundamental questions, and so many religions. Some have died out with the passing of the years, but there still remains a rich variety of religions flourishing in the world today.

The Scientific Knowledge of the World

The word science also has many meanings, from the primitive knowledge of the shamans to the highly sophisticated knowledge of today. Science is our knowledge of the natural world, but more precisely it may be defined as the totality of our organised and verifiable knowledge of nature.

The historical development of science has been quite different from that of religion, particularly in the last few centuries. It began with experiences of the world in all its variety: the rocks and minerals, plants and animals, liquids and gases, together with the results of observations of the sun and the moon, the stars and the planets. Historically, it proved very difficult to obtain a deeper understanding, to organise this mass of material into a systematic and intelligible whole. It was still more difficult to penetrate below the surface of things, to see the many subtle inter-relations between apparently disparate phenomena.

The ancient civilisations of the past had no science in the modern sense of the world. A brilliant start was made in ancient Greece, but even that failed to develop into a self-sustaining enterprise. The first beginning of modern science was in the High Middle Ages and it finally came to maturity in the Renaissance.

Science in its modern form is a detailed and quantitative knowledge of the behaviour of matter, expressed mathematically in the form of differential equations. Newton's equations of motion, together with his law of universal gravitation, provide a concise and extremely accurate description of the motions of the solar system. Maxwell's equations describe all electromagnetic phenomena, since the law of force is accurately known. Schrodinger's equation does the same for atomic phenomena, and would do the same for nuclear motions if the law of force were better known. This tightly-integrated body of knowledge constitutes theoretical physics, the paradigm of the sciences. In principle it can be extended to include chemistry, biochemistry and the biological sciences, but usually the mathematical difficulties of doing this are insuperable, and so progress can only be made by developing macroscopic concepts proper to those branches of science. Modern science is a self-sustaining enterprise, and goes forward in accord with its own internal criteria. There is still much to be learned, but its continual progress seems assured.

The Relation between Science and Religion

Thus when we come to relate science to religion we have only one science to consider, but many religions. Science and religion seems to be quite separate activities with different purposes. Science is concerned with the phenomena of natural world, religion with ultimate realities. Science tells us how things are; religion how they ought to be. It might thus seem that there is no way they could interact. And yet, historically speaking, they have interacted in many ways: most obviously, when scientists or religious authorities have exeeded the proper bounds of their subject. When this happens, the interaction can be very strong and has led to what has been called the warfare between science and religion. There have been many cases where this has occurred, and these have been eagerly exploited by secularists in order to discredit religion.

Science and religion are related in a more subtle way at the level of presuppositions. Science is based on certain very definite and quite special beliefs about the natural world, and these are religious beliefs. Some religions provide all the necessary presupposotions, some only a few, and some none at all. Those in the latter categories are inevitably antithetical to science.

The Role of Religion in the Development of Science

This subject can best be approached by asking why it is that modern science as we know it today began in Western Europe a few centuries ago, but not in any of the ancient civilizations of the past. If we look at these civilizations, in China and India, in Babylon and Egypt, in Greece and Rome, we find well-developed social structures, magnificent artistic and architectural achivements, imperishable drama and philosophy, but nothing remotely equivalent to modern sicnece. We find great skill in the working of wood and metal, ingenious mechanical contrivances and perceptive philosophical speculations about the world, but not the detailed understanding of matter, from quarks to galaxies, expressed as the solutions of a few differential equations, that is the hallmark of modern science. Most of the great civilizations of the past were able to provide all the material requirements for the growth of science. There was a leisured class, technical skills and systems of writing and mathematics. Obviously this by itself is not enough. What was lacking was the attitude of mind towards the material world that is the essential precondition of science, and in some cases a social structure that allows new ideas to flourish.

What do we have to believe before we can hope to become a scientist? We must believe that the world is in some sense good, so that it is worthy of careful study. We must believe that it is orderly and rational, so that what we find out one day will still be true on the next day. We must believe that this order is open to the human mind, for otherwise there would be no point in trying to find it. We must believe that this order is not necessary order that could be found out by pure thought like the truths of mathematics, but is rather a contingent or dependent order that can only be found by making experiments.

In addition to these beliefs about the world itself, the development of science depends on moral convictions such as the obligation freely to share any knowledge that is gained. Furthermore, once it becomes clear that scientific understanding can be applied to grow more food and to cure diseases then its future development is encouraged if we believe that we should do these things to help our fellow men.

These beliefs may seem obvious to us, but in the context of human history they are very special. They are not found in the ancient civilizations, and that is why science in the modern sense never developed among them. In some cases, particularly in ancient Greece, an impres-

sive start was made by a few individuals of genius, but they lacked the support of a coherent set of beliefs shared by the whole community, and it never became a self-sustaining enterprise.

A new beginning, a fresh style of scientific thinking, was made possible by the Judeo-Christian vision of the world. The God of the Hebrews is very different from the God of Plato or the Prime Mover of Aristotle. According to Plato, the world is generated in accord with the eternal ideas, and Aristotle's Prime Mover is the first cause from wich everything else emanates; in both cases they necessarily produced the best of all possible worlds. Furthermore, Aristotle believed that human reason can discover the constitution of the world and why it must be made as it is. In sharp contrast, the God of the Hebrews freely created a world completely distinct from Himself, and His actions are inscrutable to men unless He freely chooses to reveal His plans.

The book of Genesis bears witness to the Hebrew belief in a transcendent Creator from its opening phrases: "In the beginning God created the heavens and earth".. "And God saw all that He had made, and indeed it was very good" (Gen 1:31). In contrast to the confused creation myths of the surrounding nations, the creation story in Genesis has a clear logical structure, expressed in poetic form. It clearly expresses belief in the absolute sovereignty, rationality and benevolence of God who brings everything into being by His command and communicates His own goodness to them. Although not expressed in modern language, it contains the essential beliefs about the world that must be held if science is to flourish.

God creates freely, so it is not possible to deduce the structure of the world by rational argument, as Aristotle believed. Instead, we must examine the world by observation and experiment to find out how God in fact made it. The world is rational because it was made and is kept in being by a rational God. It is contingent because it depends on the Divine Fiat: God could have chosen to make the world in a different way. There is here a delicate balance between the rationality and the freedom of God: tip the balance one way or the other and you have a belief in a necessary or in a chaotic world, both inimical to the growth of science. Finally, we are assured that the enterprise is a practicable one, that the world is open to the human mind, because God charged us to have dominion over it, and He does not command the impossible: 'Be fruitful, multiply, fill the earth and conquer it. Be masters of the fishes

of the sea, the birds of heaven and all living animals on the earth' (Gen 1.28). Whatever wisdom we acquire, we must pass on to others: 'What I have learned without self-interest, I pass on without reserve; I do not intend to hide her riches. For she is an inexhaustible treasure to men, and those who acquire it win God's friendship' (Wisdom 7.13).

The birth of Christ further ennobled the matter of the universe, and his teaching reinforced and enhanced the teaching contained in the Old Testament. The debilitating belief in a cyclic universe, held in all ancient cultures, was decisively broken by the Christian belief in the uniqueness of the Incarnation. Henceforth history was no longer an infinite series of dreary cycles, but a linear story with a beginning and an end. Inherent in Christ's teaching is a set of beliefs about the world that eventually led to the first viable birth of science in the High Middle Ages, and to its subsequent flowering in the Renaissance.

In the early Christian centuries several philosophers examined the cosmology of creation in the context of Christian theology. In the 3rd century AD Lactantius rejected the Stoic belief that the world is simply the product of chance, without any providential design. He emphasised that God with infinite power created the world out of nothing, so that He is absolutely separate from His creation. Nature is designed by God ultimately for the benefit of men, and has no power of its own that does not come from God. This implies that nature is an inanimate mechanism operating according to fixed laws. In the 4th century AD Basil of Cappodocia insisted, contrary to Plato, Aristotle and other Greek philosophers, that nature is not animate, nor is it a living thing endowed with senses. When plants and animals grow, they do so following God's command and in accord with His laws.

The Christian beliefs concerning creation emphasizes not only that the universe was created by God out of nothing and in time, but that the universe is totally dependent on God and totally distinct from God. The universe at any instant is sustained in being by God, and without this sustaining power it would immediately lapse into nothingness.

At that time there were passionate debates about the nature of Christ, and heresies abounded. To define the true nature of Christ was the task of a series of Councils of the Church, and of these the Council of Nicea (325) formulated the creed that is widely held today:

'Credo in unum Deum, Patrem omnipotentum, factorem coeli et terrae, visibilium omnium et invisibilium. Et in unum Dominum Jesum

Christum, Filium Dei unigenitum. Et ex Patre natum ante omnia saecula. Deum de Deo, lumen de luminae, Deum verum de Deum vero. Genitum, non factum, consubstantialem Patri; per quem omnia facta sunt ...'

It is easy to recite these hallowed phrases without fully realising their impact, and still more their importance for science. The beginning of the Nicene creed asserts the creation of the universe by God: 'Factorem coeli et terrae'. One of the early heresies was pantheism that failed to distinguish between God and His creation, holding that it is in some way part of God. In the Greco-Roman world the universe was thought of as an emanation from a divine principle that is not distinguished from the universe. Pantheism is explicitly excluded by the Nicene creed when it says that Christ is the only-begotten Son of God. Christ is begotten, not made. Only Christ was begotten and thus shared in the substance of God; the universe was made, not begotten. ('Et in unum Dominum Jesum Christum, Filium Dei unigenitum.. Genitum, non factum'). Since pantheism was one of the beliefs preventing the rise of science in all ancient cultures, the Nicene creed prepared the way for the one viable birth of science in human history.

Many ancient cosmologies held that the world is a battleground between the spirits of good and evil. This dualism is inimical to science because it makes the world unpredictable. Dualism is excluded by the Nicene creed when it says that all creation takes place through Christ ('per quem omnia facta sunt').

In his Epistle to the Colossians, St. Paul says that in Christ all things took their being, and were all created through him and in him (Col 1.15). He stressed Christ as the divine logos and the consequence that the creation must be fully logical and orderly. He referred to creation out of nothing when he praises God "who restores the dead to life and calls into being those things which had not been" (Rom 4:17) and promises that through Christ they would understand "the breadth, the height and the depth" (Eph 3.18).

Inherent in the Christian doctrine of creation is the belief that God freely chose to create the universe. He was not in any way constrained either to create or not to create it in the way that He did. It is therefore not a necessary universe in the sense that it had to be created or could not have been created otherwise. There is therefore no possibility of finding out about the universe by pure thought or by a priori reasoning.

We can only hope to understand it by studying it and by making experiments. Thus the Christian doctrine of creation encouraged the experimental method, essential for the development of science.

Early in the twelfth century, Hugh of St. Victor saw the study of the natural world as a twofold process, first the ascent of reason to the purely spiritual and then a descent to examine in its light the information provided by the senses. In so doing he expressed the mathematical rationalism of Plato and inspired his contemporaries William of Conches, Thierry of Chartres and Adelard of Bath, for whom reality was autonomous nature to be grasped by reason.

In the twelfth and thirteenth centuries there was a remarkable flowering of creativity in many areas of human activity. At the sociological level, this was largely due to the new concept of treating a group of people as a separate legal entity. This enabled them to act with considerable freedom, but always subject to the law. It came about as a result of what has been called the Papal revolution, by which the Church asserted its freedom from the civil authorities. Previously, it was usual for clerical appointments to be made by the civil authorities, but now the Church insisted that it alone had the authority to do this. This established the Church as a separate legal entity and put constraints on the power of civil authorities. The most significant result was the creation of a separate legal system with its own area of jurisdiction. Once this idea was established, both Church and State became federations of many corporations, each with a measure of authonomy. Among these were cities, the first universities, the legal and medical professions, banks and business organisations and later on the scientific community itself.

In the High Middle Ages, many universities were founded by the Church to provide higher education for those educated in the monastic schools, to train future clerics and to facilitate the spread of learning. It was in these universities that the decisive breakthrough that led to the rise of modern science took place. The works of Aristotle and the other Greek philosophers were translated into Latin and were used by theologians to express the truths of the faith in more precise language, and by philosophers to refine their view of the natural world.

So great was the prestige of Aristotle that the philosophers of the medieval schools taught by commenting on his texts. Some of Aristotle's teaching, however, was inconsistant with the Christian faith, and the philosophers did not hesitate to differ from Aristotle when it seemed

necessary. In 1215 the Fourth Lateran Council decreed that all creation, spiritual and material, took place out of nothing and in time. This is directly contrary to Aristotle's belief in the eternity of the world accepted as a self-evident truth. There was intense discussion on a variety of topics, notably concerning the creation of the world and the motion of bodies. In 1277 the bishop of Paris, Etienne Tempier, found it necessary to condemn 219 philosophical propositions as contrary to Christian belief. His main purpose was to defend God's absolute power against any attempt by the Aristotelian philosophers to set limits to it. Several of the condemned propositons set limits to God's power, saying for instance that He cannot make more than one world or to move the world so as to produce a vacuum. Tempier thus reasserted the belief that God can freely create any world, just as He chooses. This was a turning point in the history of thought, as it liberated philosophers from bondage to Aristotle and channelled philosophical speculations about motion in a direction that led eventually to the destruction of Aristotelian physics, thus opening the way to modern science.

The theology of divine omnipotence had important consequences for the development of science as a result of Aquinas' distinction between God's absolute and ordained powers. God always has absolute power over all things, but he endows the natural world with specific natures, according to His plan for creation. These normally determine the behaviour of natural phenomena. It thus becomes a reasonable activity to try to find out about the world. Normally, by virtue of God's ordained power, the natural world strictly follows God's laws, and yet this does not prevent God from doing whatever He chooses by virtue of his absolute power. This reinforces the stability of nature as a sign of God's faithfulness so frequently expressed in the Old Testament (Jer 31:35-36; 33:25-26), while leaving open the possibility of miracles.

One of the medieval philosophers, Jean Buridan, was particularly interested in the nature of motion. This is the most fundamental problem of physics, and so if science is to begin it must begin here. In full consistency with his belief in creation, he wrote that 'God, when He created the world, moved each of the celestial orbs as he pleased, and in moving them He impressed upon them impetuses which moved them without Him having to move them any more except by the method of general influence whereby He concurs as co-agent in all things which take place'.

This shows a clear break with Aristotle, who required the continuing

action of the mover throughout the motion. What Buridan called impetus was later refined into the concept of momentum, and the idea in the above passage became Newton's first law of motion. Buridan's works were widely published and his ideas became known throughout Europe, and in particular to Leonardo da Vinci and hence to the scientists of Renaissance times.

The Christian belief in the creation of the world by God also undermined Aristotle's sharp distinction between celestial and terrestrial matter. Since they are both created, why should they be different? Indeed, Buridan illustrated his concept of impetus with reference to the long jump, thus implicitly presupposing that celestial and terrestrial motions are similar. This made it possible for Newton to see that the same force that pulls an apple to the ground also keeps the moon in its orbit.

Thus we see that the beliefs concerning the natural world that are part of Christian theology are the same as the presuppotions of science. and so we can understand why it was that science as we know it achieved its first viable birth in the High Middle Ages, which was the first time in history when there existed a civilization holding the Christian Faith.

Science and Other Religions

There are many religions that deny one or more of the presuppotitions underlying science, and these are necessarily in conflict with it. For example, the Manichees believe that matter is evil, thus denying the essential goodness of matter, and so they are opposed to science. Likewise the belief that matter is an illusion, held by some eastern religions, is inimical to science. Christians who live only by the Bible and reject the authority of the Church can readily accept beliefs contrary to science. Thus some interpretations that rely on the apparent literal sense conclude that the world was created about six thousand years ago, presumably with fossils embedded in the rocks. This is not only contrary to a reasonable concept of God, but is also anti-science. Further examples of beliefs inimical to science are those of the Nazis in Germany and the Marxists in Soviet Russia. The havoc wrought on the scienfitic communities in those countries is an eloquent testimony to the effects of anti-scientific philosophical presuppositions. Hundreds of leading scientists were presecuted in Germany and forced to leave, and in Soviet Russia whole branches of science, such as genetics and relativity theory, were destroyed. The experiences in these countries show very clearly that

science cannot dispense with religion, in the sense that if the essential presuppositions of science are denied, even implicitly, then science will be progressively debilitated and may even die.

The role of religion in scientific research is thus to provide the beliefs about the natural world on which it rests. These need not be held explicitly; indeed in Europe they are usually held implicitly. It is thus not essential for scientists themselves to be Christian, so long as they share the beliefs of the community. Jewish and Muslim scientists, since they also believe in one all-powerful God, hold many of them as a result of their own religious beliefs. It is not necessary for scientists to be continually adverting these beliefs during the course of their daily work. If they obtain some results that are difficult to explain this should be a stimulus to further scientific work, not an argument for the intervention of God. It is always necessary for them to show their respect for the truth and the rights of other scientists, as is required by many moral codes.

It is thus not possible to separate completely the domains of activity of science and religion. They are indeed completely separate as regards their subject matters and methods, but they do interact in several important ways. The most important is that it is religious beliefs that provide the fundamental beliefs about the natural world that provide the essential foundations of science. If these are denied, then science cannot grow or even survive.

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1. What is your definition of science and religion?

a) Science is based on measurement procedures objectively done in the physically visible and measureable world.

Religion – in its source-roots – is based on internal revelation of its prophets. Also – among other factors – on intuition and conviction of the spiritually developed men who take part in its growth.

b) The primary and declard aim of science is to gain knowledge about the laws and mechanisms which govern the outer (and to an extent inner) world.

The declared and primary aim of religion is to spiritually develope and transform mankind thus realizing what is called – in religious language – "The Kingdom of God on Earth". Internal transformation of individuals practising some religion may be noticeable also to outsiders and non-believers as an objective and visible fact.

2. Do you see any conflict between your definitions of these two concepts?

There is no conflict between *definitions*. There has been – many times in history – conflict between the real objects to which refer these definitions, i.e. between science and religion.

3. Where do you think there may be a conflict between these two?

There may be no conflict as both religion and science understand – in the light of the above sketched definitions – their respective areas of activity, methods and languages used in these activities and – what is most important their respective aims. Thus they can both, each in its own way, serve mankind in the present world and God beyond.

The conflict may arise when there are unjustified extensions beyond the respective areas of activity and/or distorsions of the above defined aims.

For example such extensions were made by various trends in science and science based philosophies which claimed that what cannot be measured and interpersonally clearly communicated

does not exist (e.g.: extreme forms of Bridgmann's operationism, of Vienna originated positivism and others). A conflict arises also when religion – by literally keeping to scriptures – tries to talk with authority about matters which should be and are a subject of science. A well known example of such "tresspassing" happens when religion tries to force a scriptural, old, pre-scientific version of the natural history of the inanimate *and animate* world (which can and should be dealt with by modern cosmology, biology and the theory of evolution).

4. What have been the grounds for the development of conflict between these two?

The conflict developed primarily on the epistemological level: by not clearly enough distinguishing between the main function of science which is of cognitive character and that of religion which is aiming at internal, spiritual transformation and development.

But there may be also – as has often been the case in our history – other grounds for conflict. The most often situation has been – and alas still is – when religion and/or science – have been used purely as an instrument for gaining political power and/or economic wealth (as happened for example many times and in many places in the history of medieval Europe with Christianity).

5. What has been the role of religion in the development of science in the West?

The development of science in medieval Europe has been enhanced by Churche's universalism and by the universal use of Latin as the language of educated people and of the Church. Later science developed rather independently and separately from religion.

6. Can we have a religious science?

A science could be qualified with this adjective if it qualified its "*meta*-spirit" and over-all objective in a universal, beneficial to all humanity way. It should neither *a priori* negate existence of the spiritual Reality nor be completely alien to its material reflections

(see point 6 below). To be more explicit:
Such a science would have to be:

1. Self – limitating – it should direct its efforts *only* in directions which might benefit mankind in the material, mental and spiritual sphere. Of course in many instances it is *a priori* difficult to say what research area *might* prove beneficial. However there are many research areas which *a posteriori* we can qualify negatively: e.g. development of ever more sophisticated and powerful weapons and means of mass destruction.

2. Holistic and interdisciplinary – as examplified by the science of synergetics.

3. Acknowledging exceptionality and sanctity of life – and in particular of human life.

4. Realisation of postulates 1 and 2 would mean among others that some of the research effort would have to be devoted to the individual and social **synergetic effects** in all spheres of human activity and interactions: emotional, intelectual and **spiritual**.

5. Practical and efficient especially in the social and spiritual area. It means that its major effort should be directed to the conservation, dissmination and implementation of the research results which have already proved beneficial: of the ever important knowledge and ever valid truths.

6. Religion may not only direct science towards morally good research goals, it can closely cooperate with research areas which are directly connected with human spiritual activities: For example one could mention here research which deals with reflections of prayer and meditation on various physical, physiological and mental human body characteristics which are measurable by scientific instruments. To be more specific: among others healing effects of prayer, change of various physiological parameters induced by meditation (e.g. change of EEG patterns and frequency of brain origination electromagnetic radition) and lead to a state of deep rest, improving social relations etc. Science cancerned with scientifically measurable reflections of the human spiritual activities and with the moral value of science's goals could be truly called *religious science* (and in the last 50 years such research has been effectively performed). The only problem now is to make universally known *and applied* in religious and every day life – for the

benefit of men and the glory of their Creator.

7. Scientific community should give lead not only in its ability to increase the body of knowledge but also in an ability to release strong "synergistic effects" – of interpersonal integration, of the spirit of co-operation and not competition – among all its members. To achieve this, the interpersonal interaction should not limit itself only to the intelectual level but should include also the spiritual level. This level could be activated by some form of common religious or other spiritual practice.

7. Can science dispense with religion?

As long as religion may furnish science with morals, humanly channeling its activities and inspiring it with the noblest ideals it cannot. A science divorced from morals, indulging in expensive research in quest of scientific fame or of military power is a dangerous science indeed. A science that may ultimatly lead to destruction of man, its creator.

8. Can one separate the domains of activity of science and religion completely?

In view of the above – see answers to questions (6) and (7) – one cannot and should not. A beautiful example of an attempt to synthetise science and religion (understood in the very general sense of spirituality, of approaching to the Divine in man) has been given in the middle of this century by French priest and scientist: Teilhard de Chardin. His vision of the evolution of our world expressing itself in a complexity curve pointing to and pulled by its Divine Attractor may be heralding development of a "great unification theory". Such a theory could be based on the modern and recent developments in the sciences dealing with complex systems: chaos theory and its orderly counterpart: *synergetics*.

Prof. Vladimir Katasonov

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Post-Doctoral Professional Experience: Teaching Mathematics in Moscow Power Institute; Working at the Institute of Philosophy of Russian Academy of Sciences (since 1986); Rector of Khomiakov's International Russian University (since 1993).

Main Interests: Religious aspects of science; the interrelation of history of philosophy and history of religion; religious roots of culture.

Publications: Works on metaphysical roots of mathematics of 17-th century; on traditions and revolutions in the history of science; on historical types of rationality; on the history of modern western philosophy and Russian religious philosophy, religious aspects of literature.

Awards: 1995 John Templeton Foundation Science & Religion Course Award.

1. What is your definition of science and religion?

Science – objective knowledge of reality. This pressupposes the subject–object division in reality, as result of which a subject cognizes an object.

Religion – the intercourse of man and God.

2. Do you see any conflict between your definitions of these two concepts?

The subject-object division defines: 1. The special kind of scientist's point of view on reality: to see in the light of general objectivity, excluding all subjective moments (personal feelings, evaluations etc.); 2. The special sort of scientific language and the special kind of communication in science: scientific knowledge is compulsory and all–meaningful one. The natural sciences tend to the discovering of so called *laws of nature*, which are, generally speaking, *a–historical, independent of time.* One invents the special kind of experience –*experiment*– through which we can be convinced, always and everywhere, in the truth of this laws.

At the same time, there are the spheres of life where the objective knowledge can't be the authentic expression of the experience. The examples: the art, the intercourse with other persons, the intercourse with God. Already, in knowledge of other persons I can't express the essence of my understanding in objective terms: my understanding of men depends on my personal attitude to them: the whole scale, from knowledge of hate to knowledge of love is possible (and the last is the most profound). In the intercourse with God I have the experience, which, especially, is not expressable, in its kernel, in objective termes. I meet in God something, which turnes to be my own the most profound essence. The revelation of God to me is, at the same time, the most profound my self–revelation. I can't divide here the object of cognition and its subject. I have to comprehend the encompassing. It demands of me the special kind of activity. It isn't the activity of some special human capacity. It's the case, where I act, as a whole. We can designate this kind of integral capasity by some name –*the heart, the person, the self* etc.– but, at the end, the main is, that it can't be algorithmized. It can't be reduced to the pure logical activity of mind.

The intercourse of man and God has essentially a *historical character*. It is the history of vows and promises, occurences and achivements, history of events, which happend in those places and in those times, but which can't be repeated anywhere and always. This history has a unique character, and this uniquness is the expression of the profound world outlook sense.

3. Where do you think there may be a conflict between these two?

Science, according to its nature, exists for cognition. It is its main goal. But, science as technology begins to influence the life itself, its organization and its ideals. So, the *utopia* arrises, as the plan of perfect organization of all the life according to scientific knowledge.

In religion, it happens, in some sense, quite the contrary. Initially, the cognitive moment, here, is subordinated to the whole: to the right religious organization of life. In religion the main goal–the salvation–is the *cognition of Truth*, as well. But, this cognition, here, is not only the pure intellectual activity. Here, the cognition of Truth means the existential embodiment of this Truth in personal life - the *communion* to the true being. So, from the point of view of religion, all the cognition is considered in the light of salvation. Hence, it may be a bad knowledge and a good one, not in the sense of degree of understanding, but from, for example, moral point, subordinated to the general religious perspective. Such an evaluation is impossible from the point of view of pure scientific cognition. In its turn, science, trying to consider the idea of salvation, can't make it otherwise, than according to the known laws of nature. This, one wants to say, assymetrical involvement of science and religion in the same domains engenders the constant tension between them, leading in the worst case to the conflict.

4. What have been the grounds for the development of conflict between these two?

The grounds for the development of conflict between science and

religion are:

α) the mutual spheres of consideration and the different natures of approaches (as it was explained above),

β) the ideological moments.

Both religion and science have the claim to be the complete truth. But the first has this right, generally speaking, and the last has not. So, when science fights for the domination above religion - it is the perversion of the nature of congnition itself: it is impossible to prove all, and to make all clear. There is the place for mystery in life, and, particulary, there are the places for the beliefs and believed presuppositions in scientific cognition, as well. The philosophy and history of science showed such presuppositions to be the essential and necessary moments of the body of science.

At the same time, religion has to *estimate* the prerogatives of science. There is no deduction of scientific theories from the theological dogmas. When religion in the West (XIII–XV cent.) tried, at first, to construct –vainly–the strict *logical systhem* with theology in the base of scientific knowledge, and, then, to compel the arising science to choose the prescribed solutions of difficult scientific questions (XVI–XVII cent.), it was experienced as the violation of reason itself, and led to the rebellion of science and, at the end, to secularization of all the culture.

5. What has been the role of religion in the development of science in the West?

The following moments, decisive for the development of western science, were the direct result of Christian world outlook influence:

α) demifologization of nature,

β) arising of classical mechanics,

γ) legalization of the idea of infinity in science.

Christianity of Middle Ages was the spiritual and philosophical base for the demifologization of nature. The supreme power of Christian God the Greator opened the way to overcome Aristotelian approach to nature. The qualitative Aristotelian *natures* of the things were replaced by the homogene inert matter of XVII–XVIII century mechanics. It is the accent on God's omnipotence in protestant theology, especially, that promoted the genesis of the

classical mechanics and mechanistic world outlook. (But, at the same time, this one-sided theological view was, also, the reason of the future impasses of mechanistic philosophy, scientist ideology, ecological problems etc.)

The medieval speculative theology opened the way to legalization of actual infinity in science. This process led to the invention of the differential and integral calculus–the base of modern mathematics and natural sciences. In the discussions of XX–th century's mathematical crisis and the so called "paradoxes of the theory of sets", one can comprehend these theological roots of the idea of actual infinity in modern science.

6. Can we have a religious science?

We can't have a religious science in the following two sense:

α) science, as religion,

β) religion, as science.

Both the ways mean, at the end, the understanding of religion, as some kind of knowledge. Such a *gnostic* view on religion was strictly condemned in Christian theology. The main goal of religion is not knowlege, but *salvation.* The salvation demands man to perform the wholistic personal *act of faith* and to live according to God's commandments. This personal act can't be algorithmized, it can't become the result of application of some formal impersonal knowledge. The salvation, as a sanctification of life, as the union between the being and God, has its own cognitive "projection", but can't be reduced to it.

7. Can science dispense with religion?

No, it is impossible to dispense science with religion. Well–founded science has to formulate its own philosophical presuppositions. This hermeneutical procedure (both in linguistic and in onthological sense) leads to formulation of some necessary conditions of knowledge, which have pre–religious sense: the existence of truth, the possibility to know the truth by human reason, and some others more special ones. The determination of the concrete historical and cultural coordinates of these presuppositions helps

to understand the links between the great religious traditions and the scientific schools. Like the rivers begin in mountains, on the *watersheds*, so there are the religious *watersheds of thought* (the term of Russian religious philosopher of XX–th century the Rev. Pavel Florensky), where the big traditions of scientific thought begin from.

8. Can one separate the domains of activity of science and religion completely?

Definitely no. Religion, as the most profound link of the being and sense, of the being and value, is inevitable base of any possibility of understanding and consideration of reality. All has a religious sense. I am sorry, *Pepsy–Cola* has the religious sense, as well. But, especially such a great human enterprise like science can't be completely separated from religion. The forced separation of science and religion leads to:

α) the shallowing of science,

β) the overestimation of scientific power, the arising of scientific ideology–scientism,

γ) the isolation of religion from culture, leading to the reduction of religious life only to cult forms.

Prof. Terence Gerard Kennedy

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Education: Studied in Rome at the Alphonsian Academy (1975-1979); Doctorate in Theology (S.T.D.), 1980.

Post-Doctoral Professional Experience: Editor of Moral Studies in honour of Father A. Regan; Memeber of the Organizing Committe for the International Bioethics Congress, Rome, April 5-8, 1988.

Professor at the Alphonsian Academy, Rome, 1984; Visiting Professor in the Department of Moral Theology, Gregorian University, Rome, since 1986.

1. What is your definition of science and religion?

Science for me means the systematic study of the natural world, that is, the world of physical as well as psychic and social phenomena. It includes the disciplines found in the modern university such as physics, chemistry, computer science··· biology, ecology··· psychology, psychiatry··· economics, sociology··· etc. This is not science in the sense of philosophy as it was understood in the ancient (Aristotle, Plato), and the medieval world. Science in this sense is often referred to as "modern science", as the type of thinking begun by Galileo and Newton. It is characterised by experimentation with precise measurements that can be mathematically interpreted. It is therefore rational in a quite precise sense and without it modern technology would never have been possible.

Religion has many meanings. It can be any system of symbols and beliefs that gives sense to the universe and to one's life. An ideology such as communism is sometimes referred to as a "religion" because it is a life-guiding philosophy. Religion in the strict sense is the result of faith in God. In the light of faith the universe becomes intelligible as God's creation and moral action as doing God's will. Religion is an organising principle for social and personal life on the basis of faith in God.

2. Do you see any conflict between your definitions of these two concepts?

I do not see these two concepts as fundamentally in conflict. I see a distinction between them. Science, for example, studies the natural world and it can study religion and religious behaviour as a phenomenom in the observable world. But it can never establish that God created this world from nothing. That depends on faith. It is obvious that there will be moments of tension to be resolved in the history of how science and religion relate. They can help and should enlighten each other mutually.

3. Where do you think there may be a conflict between these two?

There will be conflict where science leaves no space for religion, i.e.

when a scientist believes it is only possible to do science if one is an agnostic or an atheist. Religion causes conflict with science when it denies that science is not a valid way to research the phenomena of the natural wold; if it thinks that faith provides all the answers and we have no need of science to understand the phemomena of nature.

4. What have been the grounds for the development of conflict between these two?

The grounds for conflict are largely historical, at least in Europe. The type of science advanced by Galileo and Newton was something new that the medievals had not thought about in their schema of knowledge. To establish itself and its autonomous authority, this new science felt it had to rebel against the authority of the Chuch and scholastic theology which was predominant in the culture of the time. Once science's proper authority and autonomy have been recognised, "the war of religion and science" ceased. Conflict today centres more on whether one has religious faith or not and how one consequently views science.

The development of biotechnologies have lead to new conflicts. Previously birth and death were religious moments that brought people close to God. They are now manipulable by the new technologies so that many believe, wrongly, that God's power has been limited and that humans have assumed complete control of their destiny. The challenge is to show how these new technologies are to be used while observing God's law for what is best in the development and evolution of humanity.

5. What has been the role of religion in the development of science in the West?

Religion played a vital role in getting science started in Europe. The doctrine of creation was the key. God created an orderly, contingent world. In other words there are rational patterns in the natural world. But since God created the world freely i.e., he did not have to create this world as it now is but freely chose to do so, the orderly patterns in nature can only be understood

by examining them in their uniqueness and discovering how they work. So it is necessary to make experiments in order to grasp the order in a contingent universe. Christian faith is based on unique historical events, that God became incarnate in Christ. Christian faith taught that God has loved the world bringing it into existence from nothing in and through Christ. One can only discover the meaning of events by examining their actual historical reality. The whole universe, too, on the basis of a Christian understanding of the history of salvation can only be explained through its history. Christian faith provided many of the tacit presuppositions needed to get science launched. Medieval philosophy in its Islamic and Christian forms also helped by providing many of the intellectual tools needed for the "birth" of science e.g. the relation of universal to individual in logic. Many great scientists were inspired to undertake research and even to propose scientific theories that they saw as consistent with their faith-vision of God's universe.

6. Can we have a religious science?

Not in the strict sense. Science has its own proper principles and ways of understanding. Religious faith can however provide motivation for practicing science, as well as an understanding of the presuppositions that make science possible. Scientists, whether believers, atheists or agnostics can all understand each other on the level of science and its logic. They are all part of one great enterprise we call "science". Once the principles of science have been firmly established by logic and experiment, it is not necessary to invoke a faith-principle to render them internally coherent.

7. Can science dispense with religion?

No! Science can explain natural phenomena but cannot by its own resources alone discover the ultimate meaning of the universe. That goes beyond the experimental methods practiced by science. This lack of an absolute horizon in science may function as an opening to faith because it raises the question of ultimate purpose. For instance, science may go back to the first instance at the origin of the "Big Bang" but that is not the same as God creating the

universe from nothing. We could say that while it helps us know about God, it does not introduce us to God personally. One of faith's functions is to shed light on science as part of our destiny.

8. Can one separate the domains of activity of science and religion completely?

No! Separation means division and therefore lack of contact. We human beings are complex entities, with many components going to make the one unit. It is better to speak of a "distinction" between religion and science rather than "separation". Or perhaps of different levels of understanding and meaning, and that should lead to dialogue and mutual understanding.

Dr. M. Zaki Kirmani

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Educations: B.Sc., A.M.U. Aligarh (1970); M.Sc. in Chemistry, Aligarh (1972); Ph.D., Indian Institute of Technology, Dehli (1973).

Present Occupation: Chairman, Center for Studies on Science, Aligarh, India; Editor, *Journal of Islamic Science*, Aligarh.

Publications: Seven Papers on Chemistry; 16 Papaers on Theoretical Islamic Science.

1. What is your definition of science and religion?

My definition of Science and Religion is as follows:

Science: Science is Man's study of things and phenomena by way of observation and experience, for achieving certain individual and/or collective objectives.

Religion: Effecting man's individual and collective behavior, action and knowledge. Religion is consciousness of a Supra Natural which shapes man's view of himself, his position in the universe, and his relation with things therein.

2. Do you see any conflict between your definitions of these two concepts?

Things and phenomena studied in science through observation and experience do not represent total picture of reality. Their relationship to man and even their interrelationship can't be adequately comprehended by scientific method. In fact this aspect is dealt with religion. Hence for a truer picture to emerge it is necessary for science to operate in an atmosphere illuminated by religion. It means that we will have to seek religion's help in formulating concepts with regard to nature, its various phenomena, its relation with man and other possible dimensions, which can't be known otherwise. Latest manifestation of the lack of comprehensibility is the crisis in health care system and environmental issues which are a result of the overestimation of observation-experience based method employed for knowing things and phenomena. Science is not operative in religious atmosphere, it rather denies the legitimacy of religion in such matters. This appears as an essential conflict in these two definitions.

3. Where do you think there may be a conflict between these two?

Following comparative chart shows the conflict between these two:

Religion:

1. Consciousness of a supra natural is vital.

2. Man's behavior is shaped by revealed knowledge or its consciousness.

3. World-view is shaped by revealed knowledge or its consciousness.

4. Religion provides man with fundamental guidance in shaping its views and relation with regard to things in nature and thereafter sets man free to explore through sensory method.

Science:

1. It is insignificant.

2. Man's behavior is shaped by views developed on the basis of observation and experience.

3. World-view is shaped by ideas developed on the basis of observation and experience.

4. Science does not accept the guidance and explores things totally independently, and without any apriori view.

4. What have been the grounds for the development of conflict between these two?

Science is basically a demonstration of man's yearning to know and understand whatever he sees and finds around him. And this thirst for knowing is so strong that can't be quenched merely by revealed knowledge. Man infact needs to observe and experience and use his senory power in his quest for knowing.

However, when man begins to explore through observation and experience he fails to confine himself and begins to give meanings and purpose to it. In doing so he in fact trasgresses. Merely to know *how* things are going on, he ventures into *why* these are so going. Though these two are quite distinct areas but nevertheless, are likely to overlap if the doers are not conscious.

To answer *why* is infact tantamount to assigning motives, and purpose and as man himself is not operating the things and phenomena under study, this assignment remains not only tentative but also unauthentic and therefore runs a great risk. Answers pertaining to questions as to *how* things are going on are by and large experimentally demonstrable and knowable. Rather, this is the only way of knowing them. But those related to *why* are not so. In this realm when man ventures, commits mistakes and results are catastrophic. *Why* is normally answered by religion. There is a kind of *a priori* guidance which provides man with a safe and

secure ontological foundation. However, science being opposed to such knowledge does not accept it and adopts its own method even in these areas.

This obviously leads to conflict. If the religion is not authentic and does not have guidance in such issues it either wages a sort of war against science or becomes totally subservient. In such atmosphere a vertical growth of science is observed resulting in a totally unhealthy and chaotic social matrix at horizontal plane. In sound religious tradition, if existing at time, this science fails to find room. If on the other hand, the science grows in a religious culture, it finds no need to venture into such areas and a healthy growth of science is observed.

5. What has been the role of religion in the development of science in the West?

Religion in the west having no definits ideas about man and nature, and having given no freedom to its adherents to derive and develop such ideas, could not face man's legitimate urge and first resisted with power and later succumbed to the pressure. Role of religion Visa-vis science, was initially negative and finally reduced to almost naught in western man's intellectual ventures.

6. Can we have a religious science?

Yes, we can have a religious based science provided following are accepted:

a) Man needs guidance for its action and behaviors as this knowledge is beyond his comprehension based on experience and observation alone. This guidance is available through religion.

b) Who the man is? what for is he? how is he related to the fellow man? and how the things around are related to him and what basic message do all phenomena convey, these and all other similar questions are beyond man's scientific explorative ken. Tried independently man can have only partial and disjointed answers leading to tension between man and every other thing. Man's quest in this realm will be fruitful only if religious knowledges is sought and accepted as the starting point.

c) Some aspects of the knowledge are rooted in supra natural sources whereas for some others man has to use his own potentials.

Once these basic principles are accepted whatever is produced scientifically, will, broadly speaking, be religiously scientific.

7. Can science dispense with religion?

Dispened with religion, as the contemprary science is, it has become an essential source of tyranny, hegemony and violence. Being the main tool of political economic and cultural imperialism modern science, just can't continue to dispense with religion if there is peace and harmony in the store for man's future in this world.

8. Can one separate the domains of activity of science and religion completely?

This is impossible. Religion is innate in man and to do science is his basic need. As man's mind is involved in religion and so also in science, this organ can't be thought of responding completely separately and independently while switching over from one urge to another. In fact, not only the mind works in unison, even various urges influence one other. Those who believe in separation, they in fact believe in distortion and harbour a dualism in their individual and social life.

There is yet another aspect of the question. This is concerned with the contemporary issues like the choice of the problems for R and D, priorities of funding, science policy making etc. All these questions have direct link with the national and cultural consciousness which is constructed mainly by the religion, the people adhered to.

Dr. Harold G. Koenig

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Education: B.S. (1974), Stanford University, San Joaquin Delta College; MD (1982), University of California School of Medicine/SanFrancisco; M. Sc. (1989), Division of Biometry, Duke University.

Post-Doctoral Professional Experience: Family Medicine Residency (1982-85), University of Missouri/Columbia, Geriatric Medicine Fellow (1986-89), Duke University Center for Aging and GRECC VA Medical Center; Residency in Psychiatry (1989-92), Duke University; Associate Professor of Psychiatry and Medicine (since 1996), Duke University Medical Center; Director, Center for the Study of Religion, Spirituality and Health at Duke University.

Awards: Fellow Award (1990-92), American Association for Geriatric Psychiatry; NIMH Clinical Mental Health Academic Award (1993).

Publications: include 9 books, 20 book chapters and over 125 articles.

Science without religion is lame, religion without science is blind .

Albert Einstein

1. What is your definition of science and religion?

While for many years, science and religion had been diametrically opposed, they are now being used to complement and reaffirm one another. Religious professionals are beginning to see the value and contributions of science, both the physical and health sciences, that enrich and validate religious values and principles. Scientists, on the other hand, are beginning to see the limits of rational thinking, the meaninglessness of their findings divorced from religious tradition and ethics, and the shallowness of goals separated from the light of religious truths.

Defintions

Religion involves the beliefs, practices, and rituals that define one's relationship to God and to other humans. Religion is what we center our lives around and devote our lives to. Religion is what gives meaning to life's goals and hopes. Religion is what makes humans different from animals, because it forces us to recongnize something greater and beyond ourselves.

Science involves the process of acquiring knowledge or truth by systematic observation, study, and experimentation carried out to determine the nature, principles, or laws that govern the physical, psychological, social, and moral universe in which we live. Two major branches are the natural or physical sciences and the health sciences.

2. Do you see any conflict between your definitions of these two concepts?

There is no conflict, as long as the limits of each concept are understood. Religion involves the operation and principles that govern the non-physical world that we live in. Science deals primarily with the physical world that is observable and measurable.

Science cannot prove or disprove religion, which is accepted or rejected on the basis of intuitive knowledge or faith. Religion, however, can provide meaning to and guidance for the discoveries of science and their application. Science, in turn, can provide validation for universal laws and principles that govern interpersonal relationships and intrapersonal hope and meaning. Science conveys truth through the study of small parts of nature, largely isolated from other parts of nature; reductionism is required by science to tease apart the many interacting processes that impinge on and potentially bias their many small truths. Religion conveys truth and knowledge through intuitive and global processes (often stories) that make sense of and synthesize the many small turths into the overall Truth. While science provides the answers, religion provides the answers behind the answers.

3. Where do you think there may be a conflict between these two?

4. What have been the grounds for the development of conflict between these two?

Science and religion come into conflict only when their adherents try to use them to achieve goals which they were not intended to achieve - for example, when science is used to try to prove that God exists, or when religion is used to explain the purely physical domain of nature, rather than the meaning behind it.

5. What has been the role of religion in the development of science in the West?

Science in the West largely developed out of a reaction to the people's abuses and misuses of religion. Science was a new way of finding truth that was divorced from the opinions held by powerful, influential others, often in the church. As scientists have become more open to religion as an explanation behind the explanation, they are beginning to find much greater beauty, purpose, and design in what they are discovering.

6. Can we have a religious science?

Only if the study of religion uses religious tools (prayer, meditation, etc.) can it study itself. Religion can accumulate knowledge, yet it is different from the reductionistic "part" knowledge that science can achieve. On the other hand, science can be used to study the physical, psychological, and social effects that religion has on humans, without making claims to the ultimate origins of such effects. Nevertheless, science cannot use the tools of religion to accomplish its goals; it must remain objective.

7. Can science dispense with religion?

Science can certainly try to dispense with religion. It has, indeed, tried to do this for centuries. As we learn more and more through science, however, we begin to see how little we actually know. Scientists must then turn to religion to make sense of what they cannot. Also, religion is necessary for science to understand how to apply and use its findings for the ultimate advancement of mankind.

8. Can one separate the domains of activity of science and religion completely?

No. Because the parts of nature that science attempts to isolate and explain, are parts of a greater truth that only religion can understand, describe, and convey to humans.

Prof. Kalervo V. Laurikainen*

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Education: Cand. Phil., 1940, University of Helsinki; Ph.D. in Physics, 1950, University of Helsinki.

Post-Doctoral Professional Experince: Lecturer at the Institute of Technology, Turku, Finland, 1946-56; Associate Prof. of Physics, University of Turku, 1956-60; Prof. of Nuclear Physics, University of Helsinki 1960-78; Head, Dept. of Nuclear Physics/High Energy physics, University of Helsinki 1960-78; Chairman, CERN Committee, Academy of Finland, 1968-75; Honorary member of the Finnish Physical Society; From retirement in 1978 till his death in 1997, he lectured in history and philosophy of science, University of Helsinki; Chairman of the Organizing Committee for the *Symposium on the Foundations of Modern Physics*, 1985, 1987, 1990, 1992 and 1994.

* Prof. Laurikainen died a few months after sending his article to us.

THE UNITY OF MATTER AND PSYCHE

(Reflections on the Unus Mundus of Jung and Pauli)

As the correspondence of Wolfgang Pauli and C. G. Jung was published in 1992, it has been possible to form a more detailed picture of this exchange of ideas which continued for over a quarter of century. Characteristic of it is the idea of *one world*: an ontology where the whole human consciousness (and in principle even the unconscious) is considered an an inseparable whole. Thus, the subject searching for knowledge and the object of this knowledge are considered as united in a whole. Pauli arrived at such thoughts on the basis of *complementarity* uncovered in microphysical observations, Jung from his psychiatric work. I shall here describe Pauli's point of view because I know it better.

Experimental results of microphysics

Pauli started from certain experimental facts which force us to change our opinions about knowledge and reality.

Complementarity

The microworld can only be described symbolically, because it is an invisible world, and its properties can be defined only within the framework of a given theory. The best knowledge of the microworld is obtained on the basis of experiments planned according to quantum theory, and there is no possibility of comparing this knowledge with 'reality itself'. In addition, *different experimental results can give incompatible results* (*complementary to each other*). Because of this situation, reality cannot be described in detail within a rationally acceptable theory - it seems to become dim when one tries to examine it very accurately (the *uncertainty principle* of *Heisenberg*).

This feature is not caused by the imperfection of quantum mechanics but is a property of nature itself. This was the basic philosophy of the *Copenhagen interpretation* from the very beginning, and during the subsequent 70 years it has guided the interpretation of the theory and the development of the terminology describing experimental situations.

It is true that according to Einstein's opinion, quantum mechanics is not able to describe microreality completely and, therefore, one should try to develop a more complete theory for microphysics, but experiments

carried out later on (the so-called EPR experiments) have not supported his vision of physical reality. Although it is not possible to develop a theory which would correctly describe the details of the micrworld, it is however, possible to derive from quantum mechanics *statistical laws* for macrophysical phenomena in a highly reliable way. The quantum mechanical laws are found with the aid of 'matter waves'. These waves do not describe individual phenomena in detail but do give excellent statistical predictions which concern a great number of 'similar' atomic phenomena. Which phenomena are considered 'similar' must be defined with the aid of macrophysical experimental arrangements: these define a certain 'situation' in which microphenomena are investigated (the *initial state* of the system).

A quantum phenomenon is always a jump from a given initial state to a final state, the last one being predictable only in a statistical sense. *A quantum phenomenon is an indivisible whole* which cannot be described in detail. In the new interpretations proposed to replace the Copenhagen interpretation, attempts are in general made to also describe changes of state in the assumed process between the initial state and the final state. However, according to the basic philosophy of quantum mechanics, we cannot expect a development of the theory in this direction which would mean approaching determinism again, i.e., presupposing that a detailed description of individual events is possible with arbitrary accuracy.

Although the predictions are only statistical in quantum mechanics, they make it possible to govern 'atomic phenomena' in a practically reliable way, even to develop atomic technology. Therefore, we can claim that *microphysical theories give us knowledge of reality.*

Conclusion: A microphysical theory does not reach 'reality itself' but describes it only symbolically. Nevertheless, it contains knowledge of reality in the statistical sense, and this helps us to govern actual 'atomic events'.

The Basic Nature of Reality

Is it, then, possible to claim that we can obtain knowledge of reality in the ontological sense? Is the world, by its basic nature, 'material' or 'spiritual' or perhaps something else?

Bohr thought that this question does not belong to physicists. We must maintain the objectivity of physics and, therefore, avoid ontological debates. *Heisenberg* and *Pauli*, instead, seem to have thought that it is

not possible to avoid ontological questions. In fact, the perhaps most profound question of our time concerns the search for a conception of reality which is even compatible with the results of atomic research. Only physicists can reliably approach this problem.

The situation in the interpretation of quantum mechanics shows that it is not possible to describe the nature of matter without also speaking of the shaping activity of the psyche. The picture of the atomic world which we construct gets its form in the human psyche and reflects, therefore, both the properties of the psyche and the structure of the 'material' world which it aims to describe.

The basic question is: *How are the concepts created which make it possible to describe reality 'correctly', i.e., in such a way that this description corresponds to the structure of reality, and how can we find the 'right' natural laws*? The existence of the outer world is self evident for a physicist. It must have a certain structure which we must try to describe 'correctly', although we know now from the atomic theory that such a description can only be symbolical. What is the bridge between our knowledge and reality?

Pauli spoke of a *cosmic order* which governs both the functioning of the human psyche and the phenomena of fthe outer world. Analogously, Heisenberg used the term 'central order' (zentrale Ordnung). Pauli found *archetypes*, which play an important role in Jung's psychology, to be the basic elements of that cosmic order. They can be compared with the ideas in Plato's 'world of ideas'. The essential difference is that the cosmic order is not invariant: the archetypes are basic elements in a world of changes, and characteristic of them is a dynamic force which creates changes both in the human psyche and in the outer world.

Complementary Ontology

Pauli's ontological vision maintains the idea of *Cartesian dualism*, insofar as the contrast between physical and psychical is very chear. For a natural scientist, the existence of an objective reality - which is independent of our knowledge and of our decisions - is a kind of basic belief, the starting point and the moral backbone in the search for knowledge. That independent reality we try to describe with the aid of quantum mechanics. Atomic research has shown, however, that we cannot reach independent reality with the aid of empirical methods. Here we must agree with *Kant*'s conception of knowledge that the 'things-in-themselves' cannot

be reached by empirical science.

The essential difference with respect to the Kantian philosophy is, however, that statistical causalilty opens the possibility of getting statistical knowledge of reality.

Pauli used the description of the microworld as a model for ontology. In microphysics we have met a reality which manifests itself as complementary, incompatible properties - for example, in some situations as a world of localizable particles and in some other connections as nonlocalizable waves. We cannot describe the ontological nature of such a world but must be satisfied with the coplementary descriptions in different situations. However, there is a theory – quantum mechanics – which fulfills high requirements of rationality and helps us to govern all atomic events. This shows that there is a coherent microworld which appears to us in different situations in very different and even incompatible ways.

Pauli then used this model in general ontology. The world appears to us in some connections as physical phenomena, in other situations as psychic experiences. Atomic theory has given us a lesson that reality can be an abstract whole, not describable in any rational theory. Even when describing physical phenomena, one cannot neglect the shaphing activity of the psyche. Pauli spoke of a *psychophysical reality* which is an abstract whole but manifests itself as 'physical' and 'psychic' phenomena - like 'particles' and 'waves' in microphysics. This is a new ontology, the model of which is obtained from atomic theory.

'Physical' and 'psychic' correspond in Pauli's terminology to the two basic substances of Cartesian dualisum. According to Descartes, these substances are in principle independent of each other, but their mutual relation is, in fact, the weak point in Cartesian dualism. In complementary ontology, *reality is a transcendent whole*, undescribable in the framework of any rational theory. Its physical and psychic appearances can be described but the very nature of the reality itself cannot be defined. I would like to call this transcendent reality *spiritual*.

The repression of metaphysics, which for many people limits their scientific thought, maked them bound to the prevailing conception of science. Then the paradoxes in the interpretation of quantum mechanics remain permanent problems for which no satisfactoty solution has been found. The natural solution for this situation is an essential change in the conceptions of reality and the nature of science. This presupposes metaphysical considerations. In this connection, new relations between

different fields of culture can be found, even in questions which are now considered absolutely excluded. Here I would especially like to point out the relation between science and religion, for which the ontology of one world seems to open quite new perspectives (Figure: Pauli's 'world X').

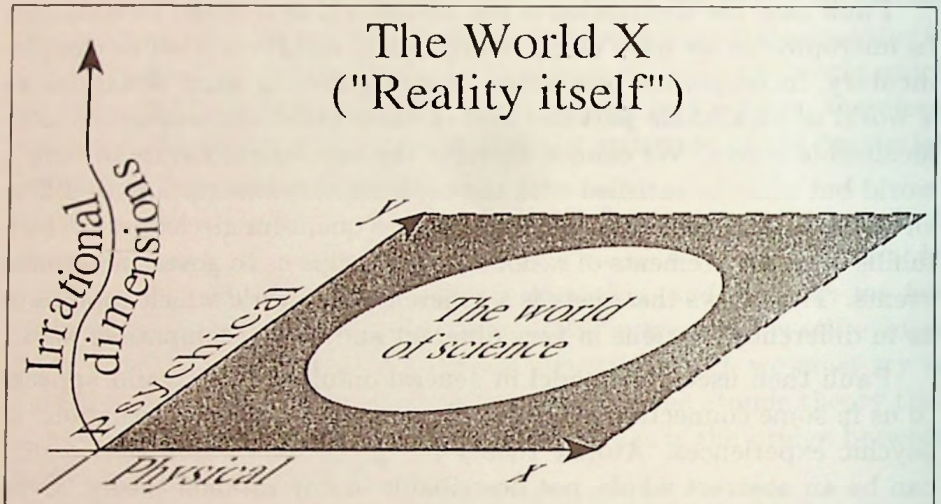

Figure: Pauli's 'World X'

The rational world of science rests on physical and psychic perceptions and experiments. Its critical analysis has shown, however, that it is not possible to find explanations for all perceptions by using the scientific methods: a complete description of individual events is not possible. Therefore the 'reality itself' remains unreachable – transcendent. It contains irrational dimensions nondescribable by science. In figure the 'reality itself', or Pauli's 'World X', is the three-dimensional space. The rational world of science is just a two-dimensional cut of reality. The irrationalities - or better: the irrational dimensions - are reachable only by faith.

My personal image of God: God is the same as reality itself, the basis of existence unreachable by reason. "In him we live, and move, and have our being."

Science and Religion

As the starting point, we emphasize here the symbolic nature of all human knowledge, i.e., the transcendent nature of reality. In science we must attempt to fulfill the requirements of rationality as strictly as the nature of matter allow, but one should always remember that even scientific description of reality is only symbolic and contains undefined elements. In metaphysics and even more in religious language, one must make compromise with the requirements of rational accuracy, and the

symbolic nature of statements is obvious. Religious truths refer more to the heart than to reason. It is necessary to point out this difference if we wish to find a harmonic relation between science and religion. If we understand that knowledge, ultimately, is always just *symbolic description of the transcendent*, it is essentially easier to find such a harmonic relation than it is on the basis of the classical, 'realistic', conception of science.

In the end, it remains a mystery that knowledge of the transcendent reality is possible. Einstein expressed this as an aphorism: "The most incomprehensible thing about the world is that it is comperhensible." In Christian terms, this is contained in the idea that *man is an image of God.* This can be interpreted as an expression of the cosmic order that, according to Pauli, is beyond the contrast of physical and psychic.

The metaphor 'image of God', however, does not mean only matters of reason. Form the point of view of life, *willing* is even more important than reason. Schopenhauer has especially pointed out the ontological importance of will, and it is useful to remember Eino Kaila's 'final balance' in his book *Syvähenkinen elänä [The Depths of Spiritual Life]: "All life is willing and will is the same as belief."*

The idea of statistical causality incorporates the idea of a creative cooperation of reason and will. Causality described by the wave function represents reson (rationalilty); the 'choices' which take place in individual phenomena represent will. The cooperation of reason and will creates 'actual' events which are not predictable. This describes God's creative activity in the world: *continuous creation* of something new. Nothing prevents believing that *teleology* is a characteristic aspect of this creation, especially in life phenomena.

In the Protestant theology, in particulay, one is accustomed to thinking that science and religion belong to different spheres of reality which do not have anything to do with each other. Because of the new conception of causality, it is again easier to understand that we can find God even in science.

For me, God is the same as reality itself - the basis of existence. He is 'I am' (Exodus 3:14) - a *transcendent, hidden God*, but certainly he is a participant and active in this world where we live and which is the object of science. Thus, although he is transcendent, he is simultaneously *immanent.* In fact, one can say that everything is and takes place in God. According to a Jewish experssion, God is the 'place of occur-

rence'. Or, in the words of St. Paul (Acts 17:28), "For in him we live, and move, and have our our being." (See figure above.)

The idea of one world emphasizes the importance of the psychic element in all knowledge that we can have of reality. However, a status equal to that of psychic things is achnowlledged for the 'physical' ones. This is characteristis of the Western thought which has created empirical natural science. In the Eastern thought, the outer world is considered secondary. and then the belief in an independent reality characteristic of empirical science grows weaker.

The emphasis on the outer world in the Western thought leads to an image of God who also speaks through his Creation and whose talk we must listen to when searching for truth. During modern times, the withness of nature has been almost forgotten in theology. The relation between science and religion has become unnatural, and this has resulted in the secularization of the Western world.

In phenomenological philosophy (Husserl etc.), the emphasis is put on the reality of the inner world - as in the Eastern thought - as if the human consciousness could freely give structure to reality. Then the idea of God's speaking through his Creation becomes dim.

Pauli's idea of complementary reality is based on the belief that reality has a given structure. We must acknowledge this and try to describe this structure 'correctly' although it remains transcendent for us. We experience reality as psychic and physical phenomena, but we cannot describe its basic nature with any rational concepts – save in the sense of a symbolic description.

Beside rationality, the *irrational will* is characteristic of reality. Will is a creative, free element which manifests itself both in the human behavoir and in nature: in the free choices. It makes reality a changing world: reality has both rational ('being') and irrational ('beboming') aspects. N.B. *Grace* belongs to the irrational aspects; God's Grace is stronger than Law but does not, however, violate it (Matthew 5:17).

In order to create, will must cooperate with reason. The human will without belief is powerless. A decisive factor is the basis of belief, its direction: towards God or away from him. This choice is more a matter of the heart than of reason, and the message of the heart cannot be misinterpreted: *God is the source of love.* This is the very mystery of creation. Under the power of selfishness, reason destroys: only in the service of love can it create.

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Post-Doctoral Professional Experience: Assistant Professor (1957), Associate Professor (1960-63), Department of Physics, Yale University; Professor of Physics (1963-95), Texas A& M University; Associate Director for Research (1965-70), Cyclotron Institute.

Awards: College of Science Distinguished Teaching Award, 1989.

Publications: 53 scientific papers, 64 talks and 8 patents.

1. What is your definition of science and religion?

2. Do you see any conflict between your definitions of these two concepts?

I am going to omit any response to questions 1 and 2 since they are concerned more with philosophical than scientific issues. On the other questions, I am pleased to offer the following answers.

3. Where do you think there may be a conflict between these two?

I do not anticipate any conflict between science and religion. For Christians, the content of religion is taken from the Bible. According to St. Augustine (about 400 A.D.), if "*the faithful report of the senses*" (science) disagrees with the an interpretation of the Bible, then the Bible should be reinterpreted to agree with science. Consequently, there can be no conflict between the Christian religion and science.

4. What have been the grounds for the development of conflict between these two?

The conflict for Christians has occurred because some Christians will not interpret the Bible to agree with science. Today, for example, some Christians insist that the world was created in six literal (24 hour) days because the first chapter of Genesis says that God created the world in six days. This interpretation leads to an age for the universe of about 5,000 years instead of the 15 billion years obtained by science. Most Christians would say that the message of Genesis is to say that God, as Creator, is greater than any of his creation such as the sun or the moon, which the nations around Israel were worshipping. The six days would be, then, a literary structure on which this message was presented.

5. What has been the role of religion in the development of science in the West?

The Christian religion was crucial for the development of science

in the West. The Greeks had taught men how to reason with Euclidean geometry (300 B. C.) being a supreme example of the power of Greek thought. But the Greeks did not discover the means to investigate nature with the scientific method. Several Christian insights were necessary to proceed from Greek thought to scientific investigation.

a) First, Christians based their attitude toward nature on the Genesis account of creation which said that God had created the world and then announced that it was good. In contrast, the Greeks placed a higher value on ideas than on the material world. Thus, geometry was an idealized discipline with a line having no width and a point no extension. But, when the material world was concerned, the Greeks would not do such a simple experiment as drop a heavy object and a light object to learn which would reach the ground first. They just assumed, in contrast to reality, that the heavy object would fall faster. Galileo in Italy (1600 A.D.), on the other hand, with his respect for the material world, did drop two objects and found that both the heavy and the light object reached the ground at the same time. Once this experiment was understood, the science of mechanics was born and subsequently the rest of modern science.

b) Second, for Christians, God the Creator was sovereign. The only way for man to learn about the creation was to investigate it. In contrast, the Greeks assumed that all the motions of bodies in the heavens were circular since the circle was the "perfect" shape and the heavens were divine. Kepler, the Christian, found from accurate astronomical data that the orbits of the planets around the sun were ellipses.

c) Third, because of Genesis, Christians believed that man was created in the "image of God". Thus, Christians were confidant that they could understand the creation since their minds were images of God's mind. Kepler devoted 20 years to studying the planetary orbits before discovering that these orbits were elliptical. He avoided discouragement by saying the "*he was thinking God's thoughts after him*".

d) Fourth, because God had created the world, nothing in the world was sacred for Christians. There were no "sacred" groves or "sacred" cows that could not be taken into the laboratory for

study. All of nature was appropriate for investigation. Of course, this did not mean that man was free to spoil his environment for Genesis also said that "*The Lord God took man and put him in the Garden of Eden to work it and take care of it*".

6. Can we have a religious science?

I don't believe so. The Christian view is that science is the study of God's creation. There is nothing "sacred" in this creation, not the sun nor the moon, as mentioned in Genesis. Science, in St. Augustine words: "*is the faithful report of the senses*".

7. Can science dispense with religion?

I would say so at this time. As discussed in the answer to Question 5, religion was crucial to the origin of science in the West. However, now that the procedures for scientific investigation have been developed, religion is no longer involved in scientific work.

8. Can one separate the domains of activity of science and religion completely?

Science and religion are separated completely from the scientists' viewpoint. However, for the Christian who believes in God the Creator, the creation is very much a part of his world view. The Bible is full of praise for the creation when it sings that "*the heavens declare the glory of God*". For the Christian the vast creation is evidence of God's great power and glory.

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Awards: Templeton Award for Science & Religion Course Development (1995).

Publications: 24 articles in Theoretical Physics and 35 in Science and Theology; two books: *The Trademark of God* (1988) and *Cosmic Witness* (1996).

1. What is your definition of science and religion?

Religion deals with ultimate reality, the "Ground of Being", or "God". Science deals in principle with the rest of reality, which is dependent upon God. (In practice, we are far from a "scientific" understanding of much of the universe). This reality which is not identical with God is the "universe". Religion is true to the extent that it acknowledges and speaks correctly of what really is ultimate reality, and false to the extent that it mistakes something else (real or imaginary) for this ultimate reality.

These definitions focus on the respective **contents** of religion and of science rather than on their **methodologies**. The word "science" is used differently if one speaks, for examples, of theology as a science. Religion, as a human phenomenon, can be studied scientifically.

2. Do you see any conflict between your definitions of these two concepts?

I see no conflict in the definitions themsevles, but that reflects my own religious beliefs to some extent. For atheists, religion in this sense would be empty because they believe there is no reality different from the world. Pantheists would object to these definitions because they wish to identify God with the universe. They might consider science and religion in the senses used here to be virtually the same.

3. Where do you think there may be a conflict between these two?

At an elementary level, conflicts arise because some religions have identified aspects of the world with ultimate reality. If one believes that storms are caused directly by a storm god, then attempts to develop scientific meteorology can easily result in conflicts with that belief system.

At a more sophisticated level, there will be tensions, though not necessarily conflicts, if one believes, as most religions do, that God interacts in one way or another with the universe. If this is the case, religion and science will both speak about phenomena

in which this interaction takes place. They will see these phenomena from different viewpoints and will not necessarily disagree about them. However, there may be differences of opinion even between people who share the same fundamental beliefs about which aspects of the phenomena should be considered "scientific" and which should be considered "religious" – or perhaps whether that distinction can even be made.

4. What have been the grounds for the development of conflict between these two?

The points noted under (3) are important here, but there are other considertations as well. Religious believers do not always recognize that sacred texts can be true in ways which differ from the truth of scientific accounts. Poetry, for example, may not provide an accurate scientific or historical account of what has happened, but may be able to convey the **meaning** of what has happened more fully than would a detailed and historically accurate account.

People have also not always made the necessary distinction between the model of the world which people in a given culture have and the religious truths which are conveyed in the language of that model. For example, the writers of the first chapters of Genesis used models of the world thought to be accurate in the Middle East some 3,000 years ago in order to speak of God as the creator of the world. But the basic message of those texts is that God is the creator of the world, in whatever way that world is described scientifically.

5. What has been the role of religion in the development of science in the West?

This is a complicated issue about which historians of science differ. But I think it can be said that the development of science was helped by aspects of the biblical doctrine of creation. The world as creation was understood to be something different from God. This meant that it was not sacrilege to analyze the world. The world as creation was believed **good**, and therefore worthy of study. Especially with the support of the philosophical tradition inherited

from Greece, this goodness of the world included its rationality. This meant that rational scientific processes could understand it, at least approximately.

6. Can we have a religious science?

My answers to the next two questions must really be considered together.

There certainly can be "religious science" in the sense that scientists hold sincere religious beliefs and respect the beliefs of others. Nothing in legitimate science requires a person to reject religious beliefs, though specific claims of some religious bodies may be contradicted by scientific findings.

Religiously based ethics can help to guide scientists in the conduct of their work, insisting, for example, that such work be done honestly and that the welfare of others be considered in developing new science-based technologies. The scientist who is a religious believer may also see his or her work as disclosing God's creative activity, and thus regard it in a sense as an act of worship. Such believes may inspire the scientist in his or her research.

But if "religious science" is taken to mean a science which claims to receive scientific infromation about the world from divine revelation or religious traditions, there are serious problems with the concept. Religion does speak of God's interaction with the natural processes of the world, but does not provide detailed scientific explanations of those processes. Religion may picture God as creating and making use of natural processes as "instruments". Science describes how those instruments work, but it does not tell us who is using them.

7. Can science dispense with religion?

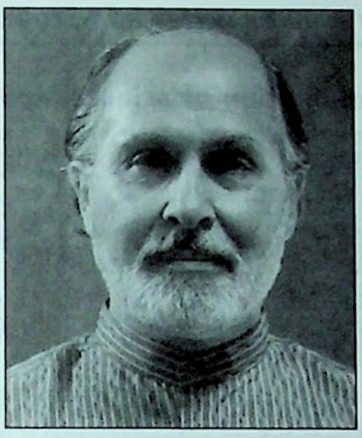
In an important sense, yes. That can be accepted simply as an empirical statement. Many people who are atheists or agnostics, as well as those from a variety of religious traditions, do good scientific work. Even people who are seriously committed to one faith or another need make no reference to their religious beliefs in connection with their scientific work.

Of course athesits would say that this is not surprising, and argue that science not only **can** but **should** dispense with religion. But one can also make the case for a positive answer to this question from a religious standpoint. If God has created a universe with rational creatures who are able to understand their world through scientific study, then God chooses to operate in the universe in such a way that the things which take place are describable by rational laws. Intelligent beings are then able to understand these laws (at least approximately) and the processes which they describe, and need go no further to ask about other aspects of reality.

However, scientists exceed their own domain of competence if they then argue that there is no reality beyond that which science can discern. Science can dispense with religion but cannot maintain that religion is empty or that science can provide a legitimate substitute for religion.

8. Can one separate the domains of activity of science and religion completely?

As noted above, most religions believe that God interacts with the universe in various ways. Phenomena in which a religion believes such interaction to take place (and for some religions these will include everything that happens in the universe) are appropriately treated by both science and religion. However, they consider different aspects of the phenomena, so care is needed in discussing the relationships between scientific and religious descriptions.



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Publications: More than 400 publications in English, Persian, French and Arabic on Islamic Philosophy, Mysticism and Science and the Environmental Crisis, including the following books: *Three Muslim Sages* (1964); *Science and Civilization in Islam* (1968); *Introduction to Islamic Cosmological Doctrines* (1978); *Knowledge and the Sacred* (1981); *Traditional Islam in the Modern World* (1987); *The Need for a Sacred Science* (1993) and *Religion and The Order of Nature*.

1. What is your definition of science and religion?

Science in answering these queries I have been asked to limit the meaning of the term science to the experimental (and I presume the mathematical without which experimental sciences as understood today would not be possible), I shall limit my definition here to modern science, that is, the science which developed in the 16th and 17th centuries in Western Europe on the basis of Islamic and Greek science, but with a very different understanding of the nature of physical reality, epistemology and the relation between the cosmos and the Divine Principle than what one finds in the traditional sciences of nature such as the Islamic.

As for religion, I understand by it revelations of Divine Origin that have led to established traditions which over the millennia have governed the life various segments of humanity. This definition therefore excludes general religious sentiment, recently established "religions" or modernized interpretations of religion resulting from the even greater secularizations of the cosmos, life and thought particularly in the modern West. My comments therefore refer to religion as traditionally understood.

2. Do you see any conflict between your definitions of these two concepts?

I see a definite conflict not only between my definitions but most of all between the two realities to which these concepts correspond of science as defined above and given exclusive right over nature as a result of which all knowledge of nature becomes limited to the scientific as is the case in the modern world.

3. Where do you think there may be a conflict between these two?

If science is accepted as a particular form of knowledge of an aspect of physical reality, then there would be no conflict in principle, but as soon as science is considered as the only legitimate knowledge of the world and what is worse all knowledge that is not scientific is either rejected or is relegated to the realm of poetry, sentiment,

imagination, subjectivism and the like, then conflict is to be found with the religious view of reality in numerous domains, some of the most important of which are as follows:

a) From the religious point of view the origin of the universe is the Divine Principle, the God of the Abrahamic religions, who transcends the domain of change and becoming. For science such a belief is irrelevant; that is why some scientists are theists, other monists, other agnostics and yet others atheists. These religious positions are irrelevant to their science.

b) For religion all authentic knowledge has its roots in the Divine Interllect and must ultimately lead to or be related to the Divine Principle whereas modern science seeks to explain the working of the whole universe without recourse to the Divine Principle. Religion has access to revelation and intellection as well as to reason, and science other to only reason and sensual knowledge arrived at empirically. Religious epistemology is different from scientific epistemology and under no condition can be reduced to it.

c) According to the Abrahamic religions as well as Hinduism and Zoroastrianism and the Shamanic and archaic religions (although some are silent on the question of cosmogony), the world has an origin and an end both of which transcend the temporal sequence of events. Although modern cosmologists speake of the birth and death of the universe, these are always considered in purely naturalistic and "materialistic" terms, a view which differs completely from the perspective of traditional cosmolgies for which the coming forth and absorption of the cosmos are both in relation to higher orders of reality.

d) All traditional metaphysics and religious views of the cosmos are based on the hierarchy of being. The physical world is the lowest level of reality above which stand the various levels of the psychic and spiritual worlds leading finally to the Divine Realm. Modern thought, as a result of the impact of modern science, has caused these levels to be reduced to a single psychophysical realm bringing about a reductionism which characterizes, if not the thought of great scientists themselves, then the general public's understanding of science. These days in Western culture, to understand anything is equated with reducing it to its material basis. While God is denied or made irrelevant to the sci-

entific enterprise, the spirit is reduced to the psyche, the psyche to biological functions, biological functions to chemical ones, and chemistry to physics. While for religions existence itself and all values descent from above, from the Source of all reality, in the prevalent scientific world-view an attempt is made to derive everything from below, from the original soup of molecules through that magical process called evolution as a result of which the greatest prophets and saints are simply the result of chance mutations and evolution of atoms and molecules which without and design but by pure accident have resulted in the paragons of human perfection.

e) For religions what appears as "laws of nature" are reflections of Divine Wisdom and in the Abrahamic monotheisms also the Divine Will. Moreover, the cosmos is not only created by God, but is sustained by Him at every moment. His creative power makes possible the existence of the cosmos here and now and at every moment of cosmic history and His Will as well as powers and beings in higher realms of existence such as the angels, to use Quranic language, penetrate into and are active in the cosmos. This view is totally against determinism from below, that is, a quantitative determinism, which governs the scientific point of view on the macro- scale whatever interpretation might be given to quantum mechanical probabilities.

f) In all religions the laws which govern the cosmos are related to ethical laws as well as religion which should govern human actions. Words such as *tao*, *rta*, *sunnat-Allāh*, and *nomos* (nāmūs) in the Far Eastern Hinduism, Buddhism and Islam as well as traditional philosophy all point to the same reality. They all mean both "laws of nature" and principles or ethical human action. In total contrast, "laws of nature" as conceived by modern science have nothing whatsoever to do with ethics although many scientists are personally highly ethical people.

g) For modern science "facts" of nature are phenomena to be studied either mathematically or discriptively in themselves. They do not refer to a higher order of reality. For religion phenomena of nature are symbols, the "signs of God" (*āyāt Allāh*, *vestigia Dei*), symbols of a higher order of reality and gateway to that order.

4. What have been the grounds for the development of conflict between these two?

All the points mentioned above are grounds for conflict, but the basic ground for conflict comes from the fact that with the Scientific Revolution a new science was born which clamied itself to be the only legitimate science of nature, opposed not only to the religious and theological understanding of nature but also to the other types of sciences of nature such as the Hermetic, which had survived into the Renaissance, but which were soon relegated to realm of "occult sciences" and superstition.

From the side of religion there also occurred in Renaissance Europe the very significant event of the loss of the sapiental and dimensions of Western Christianity within mainstream religious thought with the result that there remained only a literalism and an anti-intellectual tendency which was defenseless before the challenges of modern science. There remained no sapiental and metaphysical school accepted by the mainstream churches which could integrate modern science into a more universal metaphysical framework. Those who did show interest in such matters were soon marginalized and became known as occultists, there being a few exceptions such as the German proponents of *Naturphilosophie*. But even in their case, they were not associated in an effective manner with institutional religion in the West.

5. What has been the role of religion in the development of science in the West?

Before the Scientific Revolution science in the West was cultivated in monasteries and universities most of which were religious institutions. With the Scientific Revolution many of these universities were transformed to become centers for the propagation of science while newly founded academies such as that of Lincei in Italy and Royal Society in England, which became great patrons of science, had many members from the religious community. There also came into being Catholic orders such as the Jesuit which propagated modern science. The impetus for the growth of science did not, however, come from the Church, but after the trial of Galileo Christianity did not oppose the development of science ei-

ther except in certain cases where specific theological or ethical were involved. In the West, from the 17th century onward religion receded for the most part before the ever expanding claims of science and left the cosmos to science to explore without any appreciable religious opposition. Rather, in many cases there was encouragement from religious circles and some of the leading scientists were not only religious, but also member of religious orders of priests and ministers.

6. Can we have a religious science?

Of course one can have a religious science if the term includes the metaphysics which underlies the religious view of reality. The traditional sciences of the cosmos, whether Islamic, Indian or Chinese were sciences and at the same time religious in the sense defined above as were the Babylonian and Egyptian sciences. Even early Greek science was "religious" before religion, science and philosophy parted ways in the classical period of Greek thought. Something of "religious science" remained, however, in antiquity as can be seen in Pythagoreanism which refused to separate the qualitative aspect of numbers and figures from the purely quantitative. Even Aristotelian natural philosophy has a "religious" dimension. Hence, the ease with which it was integrated into the Islamic and later Jewish and Christian world-views.

As for modern science, to the extent that it deals with an aspect of reality, it possesses a significance beyound the physical realm and has a "religious" dimension. Modern science has, however, set a limit upon itself which forbids it from delving into the religious significance of its findings and in facts it has no right whatever to do so. Metaphysicians and theologians (who may also be scientists) can, however, draw attention to the religious significance of what has been ascertained by modern science and of course not those of materialistic philosophical assumptions which are at first accepted as hypotheses and end up by being taken as facts.

7. Can science dispense with religion?

Modern science, and not necessarily individual scientists, has al-

ready dispensed with religion and the truths of religion are irrelevant to its functioning. That is why in fact, if not integrated into a higher form of knowledge, the consequences of the spread of the scientific world-view including scientism and modern technology will end up by destroying the spiritual and ethical values of human society and ultimately the physcial existence of society itself. There is no way to derive a workable ethics for the majority of people from modern science while scientism makes unreal those very structures of reality, both divine and human, upon which religious ethics has always been based. Many scientists would love to pursue their science in an ethical context while remaining oblivious to the effect of the scientific view of reality including the human which helps to destroy the very foundation of the religious ethics upon which all human society have been based until now, but it is unlikely that such scientists will be able to do so in the distant future.

8. Can one separate the domains of activity of science and religion completely?

For some time in the West many have sought to separate these domains as a way of creating peace and harmony between science and religion. In reality, however, such a separation is not possible because science claims for itself exculsivity of knowledge of the natrual realm including the human body and now to an even greater degree the human psyche, while integral religion must also preserve its right to know the world of nature in an ultimate way. The activities of science and religion and their claims are therefore bound to collide and cannot be separated completely unless religion is relegated to an ever greater degree to the status of a subjective and private affair. having little to do with the objective world. This in fact is precisely what has happened in the West in recent centuries where in the mainstream culture religious knowledge is for the most part denied an objective status. But this event has itself led in our times to non-mainstream currents of religion seeking to re-discover the religious significance of nature including the human body.

The ideal situation would be to have authentic metaphysical

knowledge, including the knowledge of the Divine Principle and all its levels of manifestation, as the framework for both science and religion, understood in the ordinary sense of the term, so that the two would share common principles. Such a situation has existed in traditional Islam as well as in other traditions. Without these principles there is no way to create harmony between a science of cosmos that is impervious to the Divine Origin of the universe, the presence of God in His creation, the higher levels of being, the sacredness of life and eschtalogical realities and religion which is precisely based upon those realities. In such a situation separation of domains means simply an even greater ghettoazation of religion and its expulsion from the realm of nature and the world which surrounds man in his daily life. The result for most people is the turning of the realities with which religion deals into fantasy, day dreaming and irreality as can be seen so clearly in the modern world.

If there is any hope for an accord between science and religion, it is in situating science where it belongs, as a science of nature capable of knowledge of a particular dimension of physical reality and competent in allowing man to gain mastery over it, but not the only science of even the physcial realm to say nothing of the higher orders of reality which are by definitions beyond its reach. There is no possibility of harmony between science and religion unless scientific reductionism is rejected *in toto*. The ever receding power of religion and limitations set upon its domain of knowledge and activity, far from creating accord, will result ultimately in the destruction of human society. This is an act for which champions and proponents of a totalitarian science, whose claim to totality is destroying, despite its many successes, what makes human existence possible, are to a large extent responsible, as are those men and women of religion who fail to understand the challenge of modern science to the religious view of existence and cannot therefore provide an adequate response.

Prof. Hans S. Plendl

Date of Birth: June 12, 1927

Education: B.A. in Physics form Harvard (1952), M.A. in Physics from Yale (1954) and Ph.D. in Physics from Yale (1958).

Post-Doctoral Professional Experince: Joined Florida State University in 1956; Assistant Professor of Physics (1956-64), Associate Professor of Physics (1964-74) and Prof. of Physics (1979-1995) led a Nuclear Structure research group at Florida State University; participated in Nuclear and Particle Physics Experiments at Oak Ridge, Brookhaven, Los Alamos, Juelich and CERN. Since his retirement in 1995, he has been working on the applications of Nuclear Physics to the solution of environmental problems caused by nuclear waste materials.

Publications: He is the author or co-author of over 120 scientific articles of 10 articles on the philosophy and the teaching of physics, and of three books.

1. What is your definition of science and religion?

Both science and religion are human endeavors that try to find answers to basic questions such as the creation of the world and of humankind; the relationship between humankind, the world, and the forces that caused it to come into existence; the eventual fate of humankind and of the world. Science tries to find answers to such questions primarily by observation, experiment and logical-mathematical reasoning, religion primarily by faith and revelation.

2. Do you see any conflict between your definitions of these two concepts?

3. Where do you think there may be a conflict between these two?

I see no real conflict between the two: Science and religion are complementary to each other. Throughout history, there have been serious conflicts between theologians and scientists, but these conflicts have been overcome by recent developments in science and new insights in religion. Today these old conflicts persist only in the minds of those scientists who demand a strict logical-mathematical description of observed phenomena and of theologians whose tradition demands a literal interpretation of sacred writings. New conflicts of a temporary nature do arise when advances in science lead to questions of moral and theological nature. Such questions can and must be resolved by discussion among scientists and theologians of all the issues involved. Without such discussion, serious rifts between scientists and theologians are bound to develop over the implications of such recent scientific advances as the cloning of animal and possibly human life.

4. What have been the grounds for the development of conflict between these two?

Conflicts between science and religion appear to develop when scientists assume that all phenomena can be explained by science alone or when they demand that scientific investigations must proceed no matter what the moral consequences are. Such conflicts

also arise when theologians assume that they can ignore new scientific insights.

5. What has been the role of religion in the development of science in the West?

Science developed in the West by consciously separating itself from religion as much as possible. Many individual scientists continued to be followers of a religion in their personal lives, but they kept their religious beliefs and their scientific work separate, even when they contributed to both scientific and theological thought, as a few did, foremost among them Isaac Newton. Attitudes have changed considerably during the second half of this century because of recent developments referred to in [2, 3] above, so that it is not uncommon now for scientists to openly admit their adherence to a religious creed and even to hold positions in a religious institution.

6. Can we have a religious science?

To my mind, religious science is a contradiction in terms: It cannot exit, just as a scientific religion cannot exit. Science and religion are complementary but not interchangeable human activities; their premises and their methods are different.

7. Can science dispense with religion?

8. Can one separate the domains of activity of science and religion completely?

Science did dispense with religion as it developed, and it can continue to dispense with it in its further development. But scientists and theologians must interact when scientific advances result in moral questions. "Science sans conscience est la mort d'ame".

Mr. Michael W. Poole

Education: B.Sc. (1957) in Physics and M. Phil (1983) in Education in Science and Religion, King's College, London.

Post-graduate Experience: Director of Farmington Science and Religion in Schools Project (1986-88); Lecturer in Science Education (1973-91), King's College, London; Presently, Visiting Research Fellow, School of Education, King's College, London.

Publications: 50 publications in Science, Religion and Science education, including: *A Guide to Science and Belief* (Oxford: Lion Publishing, 1990) and *Beliefs and Values in Science Education* (Buckinghamshire: Open University Press, 1995).

1. What is your definition of science and religion?

I would not attempt a formal definition of either, since there so many religions in the world, some of which have no concept of God. Also, there are many different sciences, some of which, like cosmology and geology are historical in nature and non-repeatable, while others such as physics and chemistry are more concerned with repeatable experiments. Broadly, I see religion as involving belief in, and response to, God. Science is a systematic study of the natural world, employing particular methodologies and criteria for testing its truth claims. It formulates testable hypotheses, theories and laws, as well as employing conceptual models in order to understand and explain natural phenomena.

2. Do you see any conflict between your definitions of these two concepts?

I do not see any conflict between the concepts of science and religion. Largely speaking, their concerns are different and it is a mistaken view of both science and religion to see religion as filling in the gaps still remaining in scientific understanding.

3. Where do you think there may be a conflict between these two?

Conflicts may occur if a religion contains, in writings which it claims are inspired, statements about the natural world which may be in disagreement with statements made by science about similar subject matter. Great care needs to be taken, though, because religious writings utilise a great variety of literary *genres* and the author's intentions may easily, in the twentieth century, be mistaken as saying something scientific when their purpose is otherwise.

4. What have been the grounds for the development of conflict between these two?

There have been three main reasons for the development of the idea of conflict between science and religion. They concern *the data of*

science, the nature of science and *rival struggles for power.*

The data of science

As indicated in (3) above, conflicts may occur if statements in sacred writings appear to conflict with the *data* of science. Traditionally, the debates have been about issues like the origins of the universe (stellar evolution), life (chemical evolution) and species (organic evolution) as well as the position, status and age of the earth.

The nature of science

The *nature* of science has sometimes been presented, wrongly in my view, as in opposition to religious belief. The issues which have arisen in this category concern the scope, limitations and status of science and include that once fashionable philosophical system known as logical positivism. They also incorporate matters of determinism, freewill, chaos theory, miracles, scientific laws, the uniformity of nature, orderliness, causality, explanations, reductionism, emergence, language (analogies & models) and creation.

Rival struggles for power

Struggles have taken place, as for example in England in the nineteenth century, to wrest cultural supremacy from religious authorities and to transfer it to the scientific community. Part of the strategy for trying to accomplish that end was to promote popular presentations of science as antagonistic to religion.

5. What has been the role of religion in the development of science in the West?

Belief in a rational, orderly, non-capricious God inspired a measure of confidence in human reason, as well as a belief that nature, too, was orderly and intelligible. Without such beliefs in rationality, orderliness and intelligibility, science is impossible.

God's command to manage the creation appeared to encourage science as a way of doing it, since it seemed likely that the creation could be managed better if one knew how the world worked.

God, it seemed, could be glorified through a scientific study of the world which could help alleviate suffering and also disclose God's wisdom and power.

Creation was viewed as a free act of God and so experiments needed to be done to find out about it, rather than looking to reason alone for answers, or to the writings of authorities such as Aristotle.

Where God was identified with the world (pantheism), as was the case with some of the ancient Greeks, experimentation on a semi-divine nature was seen as something like sacrilege. Experimental science was consequently discouraged by such a view. However, where there was widespread belief in a God who was distinct from creation (although involved with it), that obstacle was removed.

6. Can we have a religious science?

If by 'can we have a religious science?' is meant 'can science be practised and accommodated within a religious world view?', the answer is clearly 'Yes'. Christian, Jewish and Islamic scientists see science as a major human activity operating within the wider perspective of a world which God has created and for which He holds us responsible. But a person does not have to hold religious beliefs in order to be a scientist, and many people do not hold such beliefs.

7. Can science dispense with religion?

If this question means 'can one do science without being a religious believer?' the answer, as indicated above, is 'Yes'. If it means 'does science do away with religion?', the answer is 'No', in spite of frequent claims that it can.

8. Can one separate the domains of activity of science and religion completely?

I do not think these two domains can be completely separated. Certainly there are logical differences in their concerns and their

methods. But since religion is concerned with the whole of life, and science is a major component of human activity, there is an interplay between the two. Furthermore, as indicated in (5), belief in God leads one to expect the world to be orderly, intelligible, rational and largely uniform in its behaviour – presuppositions without which there could be no science. Furthermore, the moral aspects of religion can inform decisions about the *applications* of science.

Prof. Mazhar Mahmood Qurashi

Date of Birth: 1925

Education: Ph.D. in Physics (1949), Manchester University; D. Sc. (1962), Manchester University.

Post-Doctoral Professional Experince: Chief scientist in the Ministry of Defense, Pakistan; Professor of Physics at Quid-e-Azam University; Member, Pakistan Council of Scientific and Industrial Research; Director General, Appropriate Technology; Director of Studies at National Science Counsil; Director General, National Physical Standards Laboratory; In 1964, he was elected as fellow of the Pakistan Academy of Sciences; In 1972 he was awarded open Gold Medal of Academy of Sciences; Secretary General of the Pakistan Academy of Sciences (1988-92); Secretary of Pakistan Assoc. Hist. & Phil. Sci (since 1988); In 1988, he was elected as fellow of Islamic Academy of Sciences. He was awarded Sitara-Imtiaz in 1991.

Publications: over 190 research papers in various topics in applied physics, physical chemistry and scientometrics.

1. What is your definition of science and religion?

Science: Systematic knowledge of nature, based on study of reproducible phenomena, so as to determine the laws governing these and their immediate causes, and to utilize these for human uses;

Religion: An organized system of faith and worship of God (Allah) as a supreme power, entitled to total obedience in our daily personal, social and collective conduct, usually with the hope of ultimate reward after death.

2. Do you see any conflict between your definitions of these two concepts?

No. There is, in fact, a certain region of overlap, which could be considered as a corollary to the proposition that the universe and also its laws are made by its Creator; these laws encompass the physical, biological, social and spiritual spheres, and the overlap may be exemplified by psychokinesis, E.S.P., socio-economic theory, etc. [see fig. 1(a)].

3. Where do you think there may be a conflict between these two?

In areas like mysticism and social science, where the parameters and assumptions regarding human behaviour are numerous but ill-defined, and where human free-will, supplication, etc., operate. The increasing margin of error or deviations from causality, as we go from physical sciences to biological sciences, and then on to social sciences, indicates the imperfectness of our knowledge of their laws and also leads to situations of conflict e.g. the social scientists may propose a short-term remedy, with after-effects, [fig. 2(b)], while a particular religion may prescribe a workable long-term remedy. Of course, there is inadequate understanding of the limitations of scientific studies. [see fig. 2(a): Region of uncertainty from 50% to 90%].

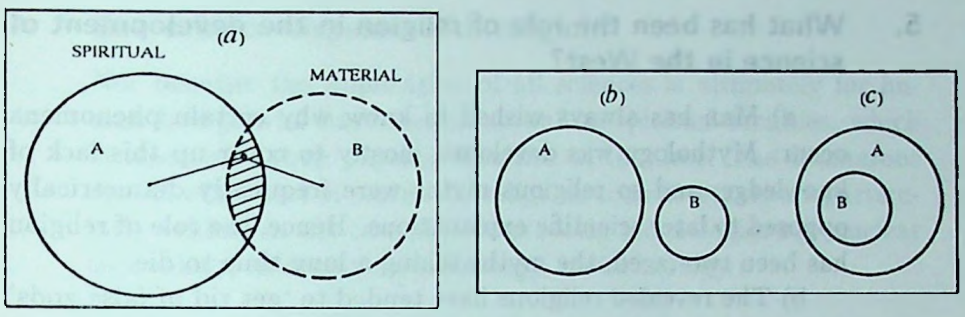

Fig. 1. POSSIBLE RELATIONS BETWEEN SYSTEMS "A" & "B".

4. What have been the grounds for the development of conflict between these two?

a) Dogmatic extrapolation of the laws/rules of one domain into the other domain, without adequate study of their limitations and definitions [see fig. 1(c)], e.g., in going from the physical to the spiritual domain. A careful study of phenomena like extra-sensory perception and psychokinesis may help to resolve this conflict.

b) Most religious philosophies tend towards "mystification" of phenomena, looking for the most far-fetched explanation rather than the obvious one, or insisting that the ignorance of something is inherent or universal, whereas science favours the simple and direct explanation, as well as the spread of knowledge of reproducible phenomena to all mankind.

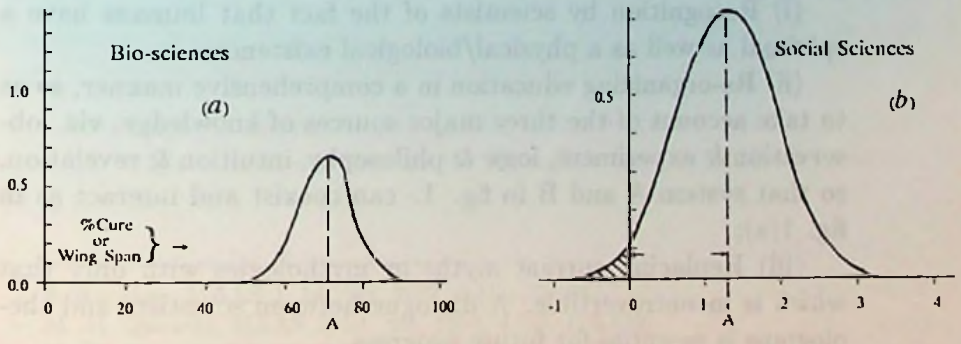

Fig. 2.

5. What has been the role of religion in the development of science in the West?

a) Man has always wished to know why certain phenomena occur: Mythology was developed mostly to cover up this lack of knowledge, and so religious myths were frequently diametrically opposed to later scientific explanations. Hence, the role of religion has been two-faced, the myths taking a long time to die.

b) The revealed religions have tended to 'get rid of false gods' and so have tended to be associated with more or less rational explanations of physical and sociological phenomena and, therefore, also with science; but have frequently succumbed to prevalent myths, which took a long time dying out. So, there was initial religious support for science as an exploration of the Creator's purpose, followed by antagonism later in the west.

c) The Islamic impulse operating for the first 6-8 centuries generated a scientific attitude that was later taken up by the West as a part of the worship of God, to begin with, but soon fell foul of Church dogma, [see fig. 1(c)]. Today, western scientists are evenly divided into those who see a connection with religion (fig. 1a) and those who want the two to be separate (fig. 1b).

6. Can we have a religious science?

Yes; to some extent it is possible to develop a science that sets out to be in cosonance with human spiritual values. Some requirements for this would be:

(i) Recognition by scientists of the fact that humans have a spiritual as well as a physical/biological existence;

(ii) Re-organizing education in a comprehensive manner, so as to take account of the three major sources of knowledge, viz. observation & experiment, logic & philosophy, intuition & revelation, so that system A and B in fig. 1. can coexist and interact as in fig. 1(a);

(iii) Replacing current myths or mythologies with only that which is incontrovertible. A dialogue between scientists and theologians is essential for future progress.

7. Can science dispense with religion?

No; because the application of all sciences is ultimately for human beings who have mental as well as spiritual faculties, which interact with their physical faculties all the time. The disasterous results of neglect of moral and religious considerations are particularly evident in the case of various recent technologies e.g. nuclear technology, information technology, biotechnology.

8. Can one separate the domains of activity of science and religion completely?

No. In fact, there is a definite overlap between these two, as indicated in fig. 1(a), which varies from one scientific discipline to another. It is this region of overlap that merits careful and deep study, as indicated in several recent papers by M. M. Qurashi and others scholars[1]. Further study of the nature of the uncertainties in fig.2 may well lead to a better understanding of the inter-connection between the physical and spiritual domains.

1. S. Kocabas, MAAS J. Isl. Sci, 1987, 3 (1), 33. 43.
M. M. Qurashi, MAAS J. Isl. Sci, 1988, 4 (2), 115-120.
M. M. Qurashi, Islamic Studies, 1989, 28 (1), 55-75.
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M. Golshani, Isl. Th. & Sci. Creat., 1995, 6 (2), 7-32.

Prof. Karl Helmut Reich

Date of Birth: May 7, 1923 (Krefeld, Germany)

Education: Studies in Physics and Electrical Engineering at the Universities of Köln, Aachen, Braunschweig, Paris and Nottingham; Doctoral degree in Physics (Notthingham) and in Electrical Engineering (Braunschweig). Social Science studies at the Universities of Braunschweig and Fribourg.

Post-Doctoral Professional Experience: (Visiting) Research Fellow at Harvard (1955), Brookhaven National Laboratory (1965/66), Dortmund University, FRG (1983), Tokyo State University (Todai, 1984); (Senior) Physicist at CERN (Geneva, Switzerland, 1955-1983); Research Fellow at the Pedagogical Institute of Fribourg University (German Branch, since 1984); Professor at the non-residential Senior University at Richmond (British Columbia, Canada) and Evanston (Wyoming, USA), School of Religious Studies and Sacred Traditions; Consulting Editor of the *International Journal for the Psychology of Religion* (since 1995).

Awards: Templeton Foundation Award for an article in Humility theology (1995). William James Award of the American Psychological Association, Division 36 (1997).

Sample Publications: Co-editor of five edited volumes on Religious Development and on Relational and Contextual Reasoning; co-author of some 20 chapters in various books; dozens of articles in peer-reviewed professional journals.

1. What is your definition of science and religion?

a) Science is a human enterprise aimed at investigating order and regularity in the natural world. Pragmatically, the knowledge gained serves in the best of cases to support life in all aspects, in the worst of cases, unfortunately to destroy life. At a deeper epistemological level, science aims at understanding as much as possible about the structure of the world and the processes taking place. Science is essentially after causal explanations, and hence on the lookout for antecedent conditions, which would explain the consequent state. Hence, science cannot explain a step from nothing (no matter, no energy, no space, no time, no "natural laws", etc.) to something. It cannot explain, why there is something rather than nothing.

b) Religion is a multifaceted phenomenon, found in practically all human cultures. It is a major attempt (1) to come to terms with the contingencies of life, the events human beings cannot control, and which could occur differently, or even not at all, at least at that particular moment in time (such as natural disasters including flooding, long periods of drought, earthquaks, illness and death, etc.), and (2) to provide a framework for societal and individual life, which ensures social cohesion, gives meaning, and fosters stability and continuity, yet is (slowly) adaptable to changed circumstances.

2. Do you see any conflict between your definitions of these two concepts?

The two definitions (1a,b) being rather abstract, they can be interpreted in such a way that conflict is avoided, but also in the opposite way. I have written two articles about that issue:

(i) The doctrine of the Trinity as a model for structuring the relations between science and theology. *Zygon: Journal of Religion & Science* 30, no. 3 (September), 1995, 383-405. (John Templeton Foundation Award).

(ii) A logic-based typology of science and theology. *Journal of Interdisciplinary Studies* VIII, no. 1-2, 1996, 149-167.

3. Where do you think there may be a conflict between these two?

A conflict could arise if either side oversteps the limits implied by the definitions (1a,b), for instance if science claims "to read the mind of God", that is to "explain" fully the origin of the universe, or if religion claims to "explain" in detail and for all times *how* the univers was brought about.

4. What have been the grounds for the development of conflict between these two?

Conflict occured primarily as a fight for power over people's minds and even lives. On the surface, it started with issues such as indicated in point (3) after it became clear that the new science (beginning in the Renaissance) had a much increased explanatory power due to new empirical observations and the application of mathematics, that it became more autonomous.

5. What has been the role of religion in the development of science in the West?

From about Galilei's time (1562-1642) an important paradigm of scientists was that of God's "two books, Scripture and Nature". As a consequence, scientific research was in principle considered an expression of religiousness. In fact, for Johannes Kepler or Issac Newton doing research and studying sacred texts was all of one piece. a higher power could be discovered – however dimly – in either way. This was also facilitated by the belief that (a) the heavenly bodies were not divine, and hence it was all right to study them profanely, i.e. scientifically (not so, e.g., in ancient Egypt), and (b) the world was contingent, and hence needed to be studied empirically (not Plato's view, for whom only the eternal forms were "real", and hence worthy of serious study).

6. Can we have a religious science?

If I interpret the term correctly, the science of Kepler or Newton could have been called a religious science in as much as it

was explicitly conceived as compatible with an Ultimate Reality (God), without however, abandoning strict scientific standards rather than favour purely religious assumptions.

7. Can science dispense with religion?

In my personal opinion the answer is "No". As experience shows, human beings need a genuine higher authority which makes for distancing oneself from one's own self so as to avoid self-adulation and hubris. The problem is to find a religious community (such as that of St. Francis) where such an attitude is practiced (as opposed to using religion for power games).

8. Can one separate the domains of activity of science and religion completely?

As indicated in point (1a,b), a conceptual separation is possible. Well known is the case of Michael Faraday, who is said to have prayed in one location and researched in another, never mixing the two activities. There is also the view that science answers the question "How?", and religion the question "Why?", or that science deals with the natural and religion with the supernatural.

However, to my mind, it is more fruitful for either field if some interaction is admitted and practiced (cf. my publications listed under point 2). Beneficial roles of religion for science were already indicated in points (5) – increased motivation – and (7) – keeping science at a sufficiently high ethical level. Science can contribute to religion by (a) pointing out wonders of God's handiwork that do not meet the unprepared eye, and (b) evolving methods that could also be useful in religious studies and theology (e.g., carbon dating, text analyses by computer, etc.).

Prof. Giuseppe Sermonti

Date of Birth: 1925 (Rome, Italy)

Post-Doctoral Professional Experience: Professor of Genetics at the Universities of Palermo and Perugia; Elected Vice-president of the XIV International Congress of Genetics in Moscow, 1978; Co-founder of the Osaka Group for the study of Dynamic Structures; Editor in Chief of *Rivista di Biology / Biology Forum*, since 1979.

1. What is your definition of science and religion?

Science may be defined as an approach to the knowledge through reasoning and experience. Religion is such an approach through revelation or tradition. Science puts emphasis on Utility (although not immediate) and Religion on Significance. While Science is man-made, Religion makes man.

2. Do you see any conflict between your definitions of these two concepts?

There is not *a priori* conflict between Science and Religion as defined above. They could complement or confront each other. There is however a historical diffuse intention in Science to abolish Significances and to replace the natural and supernatural scenary provieded by Religion with a purely mechanical represenatation of the world. A conflict between Science and Religion rises whenever Science assumes to cover the whole reality ("scientism") or when Religion pretends to dictate to Science the limits of the assertable or the facts of the latter's investigations.

3. Where do you think there may be a conflict between these two?

The crucial conflict between Science and Religion is anyway on the Ethic ground. Science tends to discount any human achievement which is not rational experimental (faith is considered as naive prejudice and a sin against Reason). On the other side, Religion has often perceived a scent of heresy and diabolic in the wild nature as well as in the man's (and woman's) instincts. To some extent there has been a convergence of Science and Religion against the phantastic and the prodigious, i.e. against the sorcerers and the witches.

4. What have been the grounds for the development of conflict between these two?

The historical conflict between Science and Religion (during the Renaissance) rose from the pretence of Science to make statements

with religious implications ("The sun is the center of the Univers"). Thus the two forms of knowledge entered into conflict as two contrasting religions. Later the religious pretences of Science faded (Science accepted the conventionality of its truths, as Bellarmino pretended) and Science and Religion found a kind of agreement about their own jurisdiction. As Robert Musil paradoxically remarked, Science was expected to deal with real but trivial things and Religion with unreal but supereme things.

5. What has been the role of religion in the development of science in the West?

Science does not create values (see Jacques Monod 1970). It is founded on human values preceding the origin of Science and also worth outside of itself. Such values are the search for truth, the appreciation of order, the belief in the existance of stable laws, the honesty, the sacrifice, the humanitarism, as well as the above mentioned distrust on the marvellous. All these values Science derived from Religion and Tradition.

6. Can we have a religious science?

Ancient Sciences, as Alchemy, Astrology, Mantic Art, Hermeneutics, Eschatology, were indeed "religious sciencs". They were gradually replaced by Chemistry, Astrophysics, Forecasting, etc. Their conversion took place through a dismissal of the spiritual commitment on the side of the operator. An alchemist participated to the purification of the matter by his own purification, a chemist may be a merchant or a delinquent, with no assumed effect on his work.

A religious Science can still be figured also in the present. It should avoid the ethic (or politic) issues and view Science as representation of Universe and Nature. The scenaries may turn out not be equivalent. Adam and the Ape are surely not coincident, but they are conflicting just because the Ape was not an unbiased result of a scientific investigation, rather a symbolic being put there to replace and to sneer at Adam and his divine origin. Addressed to the majesty, the grace and the mystery of being, the Religious

and the Scientific knowledge may merge and enter into an alliance, as an ancient Wisdom, involved in the exegesis of sacred texts and icones or in the contemplation of the precious fresco of nature.

7. Can science dispense with religion?

At its origin Science could not dispense with Religion, it was a branch of Theology. Presently it requires a religious inspiration, not to become involved in practical and political issues and to avoid subtle virtuosities about nothing.

8. Can one separate the domains of activity of science and religion completely?

Separating Religion from Science would be so absurd as separating Mathematics from Physics. One scientist can be more theorethical, another more experimental, one more addressed to the Earth and another to the Sky. Thus a religious man may be a theologist, a mystic, an eschatologist or a theodycean. They may adopt different Liturgies, but all deal with the indivisible Being, and its mysterious order and unprodictability.

Prof. Huston Smith

Date of Birth: May 31, 1919

Education: A.B. (1940), Central Methodist College, Fayette, MO; Ph.D. in Philosophy of Religion (1945), University of Chicago.

Post-Doctoral Professional Experience: Assistant through Associate Professor of Philosophy (1947-58), Washington University; Professor of Philosophy (1958-73); Massachusetts Institute of Technology; Thomas J. Watson Professor of Religion and Distinguished Adjunct Professor of Philosophy (1973-83), Syracuse University.

Publications: 67 articles and 9 books, including: *Forgetten Truth*; *Beyond the Post-Modern Mind*; *One Nation under God*; *The Triumph of the Native American Church.*

1. What is your definition of science and religion?

Science studies the empirical world. Religion seek to understand and bind us to the entire scheme of things in which God is preeminent.

2. Do you see any conflict between your definitions of these two concepts?

Not if, and when, each sticks to its proper task.

3. Where do you think there may be a conflict between these two?

When either oversteps its proper limits. Religion does this if/when it interferes with science's attempts to understand the empirical world, the physical world of nature. Science oversteps its limits if/when it claims to be able to access, and give definitive answers (without the help of religion) to ultimate questions, such as who are we, how did we get here, what is the meaning of life, and is there life after death?

4. What have been the grounds for the development of conflict between these two?

Because, historically, both have overstepped their proper bounds. In the West, theologians were guilty of this when (in the 16-17th centuries) they interfered with scientific pursuits. Now the shoe is one the other foot. Today, most of the transgressions come from science's side.

5. What has been the role of religion in the development of science in the West?

This is a complex subject that does not admit of a short answer.

6. Can we have a religious science?

No. But we can have a science that is completely compatible with religion.

7. Can science dispense with religion?

Yes. But human beings cannot.

8. Can one separate the domains of activity of science and religion completely?

Their rightful provinces can be distinguished. But they should complement each other – fit together like the pieces of a jigsaw puzzle – in providing us with a comprehensive view of whole of reality insofar as such a view is humanly attainable.

Prof. Wolfgang Smith

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Education: B.S. in Physics, Mathematics and Philosophy from Cornell University, 1948; M.S. in Physics from Purdue University; Ph.D. in Mathematics from Columbia University.

Post-Doctoral Professional Experience: held faculty positions at M.I.T. and U.C.L.A. and Oregon State University; Professor of Mathematics at Oregon State University from 1968 till his retirement in 1992.

Books: *Cosmos and Transcendence*, 1984; *Teilhardism and the New Religion*, 1988; *The Quantum Enigma*, 1993.

1. What is your definition of science and religion?

We may take it that the object of natural science is to understand the operations of Nature through the discovery of natural laws. Each particular science, however, is defined by its own methodology, and is therefore concerned, not simply with Nature or Reality as such, but with a particular stratum or level of reality, determined by what might broadly be termed its means of observation.

Religion, on the other hand, has to do with the ultimate good of man, and is consequently concerned, first and foremost, with the relation between man and God. Religion is not, moreover, a man-made thing, an institution that has somehow "evolved" as one is nowadays prone to imagine, but is based upon a divine revelation. God reveals Himself to man, and the substance of this revelation is passed on through scripture and oral tradition. This sacred legacy, moreover, comprises two aspects: a Truth, namely, and a Way; and the two are complementary, which is to say that each implies or presupposes the other. Strictly speaking, therefore, the truth of a religion can be gaged only by those who have progressed upon its way of sanctification; no religion can ever be adequately comprehended "from the outside".

2. Do you see any conflict between your definitions of these two concepts?

While there is no antagonism between science and religion in the sense of an inherent contradiction or incompatibility, conflict does arise on account of certain mental limitations and various false ideas. Scientists, for their part, have generally erred by failing to realize that their methods of inquiry give access, not simply to reality as such, but only to certain levels or aspects, as I have said before; and thus they tend to espouse a reductionist world view. In effect one maintains that whatever cannot be comprehended by scientific means must *ipso facto* lack objective status and pertain consequently to the subjective domain. One may very well admit that such "fantasies" can indeed be useful or even necessary to human life; and yet the ontological denial remains in force. Such, in essence, is the prevailing scientistic attitude towards the phenomenon of religion; as Einstein once put it: "Science deals with

what *is*, religion with what ought to be". But clearly, this position amounts to an outright rejection of religious truth as understood "from within". And the response by theologians in the West has been for the most part pathetic. Awed into submission, many have set about to re-interpret religious doctrine along more or less subjectivist lines, thereby reducing religion in effect to a kind of psychotherapy or social activism, as the case may be. Religion in the West has thus become increasingly divided into a traditional and a modernist camp. It needs however to be clearly understood that a secularized religion is in reality no religion at all, but can only be a profane and more or less trivial counterfeit. And I would add that few things in the world are more insipid and boring than an "updated" church.

3. Where do you think there may be a conflict between these two?

As I have already indicated, the primary cause of conflict between science and religion lies, I believe, in the scientistic tenet of reductionism. To be more specific, it lies fundamentally in the belief that all objectively existent things are in reality "nothing but" aggregates of molecules or subatomic particles. This, in a nutshell, is the ontological premise that is being disseminated in our schools and universities as a scientific fact. However, as I have argued in my recent book, *The Quantum Enigma*, the tenet derives in reality from a philosophic postulate introduced by René Descartes, which is in principle unverifiable, be it by philosophic or scientific means. It turns out, moreover, that the seeming paradoxes of quantum theory which have prompted physicists to propose various new and strange world views – such as the truly bizarre "many worlds" hypothesis – can in fact be traced to the reductionist premise, which physicists habitually (and gratuitously!) presuppose.

It is important to note that this primary scientistic fallacy gives rise to and underpins other scientistic beliefs, which are no less spurious and no less antagonistic to religion. The most important case in point is doubtless the tenet of Darwinism, which once again is reputedly founded upon scientific facts. However, as many have come to realize by now, this is actually not the case. On the

contrary, as I have pointed out elsewhere, one requires various *ad hoc* hypotheses, each as improbable as the Darwinist thesis itself, to shore up the theory in the face of plainly hostile facts. I contend that scientists accept Darwinian evolution, not on the strength of scientific evidence, but because the reductionist premise leaves no choice in the matter; after all, in a universe consisting ultimately of subatomic particles and nothing else, no other means of biogenesis and speciation can evidently be conceived.

When it comes to first origins, be it of life, of species, or of the universe in its totality, the methods of science prove finally to be inadequate. This, to my mind, is what the discovery of the initial singularity or so-called big bang demonstrates in the domain of cosmogenesis: there is invariably a limit in the investigation of origins beyond which the methods of science cannot be applied. The conflict between science and religion will abate, I believe, once scientists learn to recognize and respect these natural and inevitable bounds.

4. What have been the grounds for the development of conflict between these two?

It follows from what has already been said that the conflict between science and religion stems mainly from a failure on the part of scientists to distinguish clearly between scientific facts and scientistic beliefs. It is this lack of philosophic clarity, this intellectual confusion, that accounts for the fact that scientists have promulgated philosophic opinions of the most dubious kind as established scientific truths, and in the name of science have thrust upon an awed and credulous public a shallow world view for which in reality there is not a shred of scientific support. Having gained the trust and admiration of society by virtue of the technological wonders over which they dispose, scientists as a class have usurped their authority by predisposing the public against the truths of religion. I am not suggesting, of course, that they have consciously deceived others, but rather contend that they have themselves been misled in matters pertaining to philosophy, metaphysics and religion. Meanwhile these "blind guides" are exerting an inestimable influence upon education and public belief, with disastrous consequences to human welfare, both here and hereafter.

5. What has been the role of religion in the development of science in the West?

I am not enough of a historian to answer this question in detail, or with complete assurance; but it has often been claimed that the roots of science in the West lie in theology. It is not difficult to see, moreover, that the twin concepts of natural law and the intelligibility of the universe – down to its smallest parts – could well have been inspired by theological speculations. After all, a world "made" by the Logos, the Word of God, could hardly be chaotic, haphazard, or unintelligible. One also knows that the founders of Western science were steeped in religious belief, and that Newton, for one, devoted much of his later life to theological studies. Moreover, despite the widespread atheism presently to be found in the West, it is worthy of note that some of the greatest scientists of our century did believe firmly in God and draw scientific inspiration from that belief, as was the case, for instance, with Albert Einstein, Max Planck, Niels Bohr and Erwin Schrödinger.

6. Can we have a religious science?

In as much as there is no intrinsic conflict between science and religion, it is certainly possible to be both a religious believer and a scientist, or to put it more emphatically: to be fully a religious believer and fully a scientist. Moreover, given the fact that Nature reflects the Wisdom of God, and that all natural law is ultimately grounded in the divine Principle, it is clear that a man of religious faith can very well draw inspiration from the practice and findings of science. Enlightened by sacred doctrine, he may indeed attain to a far deeper understanding of what science has unearthed than is possible from a profane or secular point of view. I am fully convinced that science, restricted to its own level, is in fact unable to comprehend the higher meaning or metaphysical significance of its own discoveries.

7. Can science dispense with religion?

As the cosmos itself does not stand in separation from God, so too science cannot for long stand and prosper in separation from

religion. If indeed its roots lie in theology, as we have said, it is hardly surprising that science needs periodically to draw sustenance from that ground if it is not to wither and eventually die, or what amounts to the same: degenerate into a merely technological enterprise. One might add that a number of scientists, beginning with Albert Einstein, have in fact voiced concern that science may now be heading in that direction: that the erstwhile quest for truth may give way to an unmitigated pursuit of power. One thing, however, is clear: if and when this reduction shall be accomplished, there will no longer be an Einstein or a Heisenberg, or indeed a creative scientist of first rank; only technicians, monotonously plying their trade.

8. Can one separate the domains of activity of science and religion completely?

As we have already indicated, the domains of science and religion cannot be separated completely without serious detriment to both. It is in fact the separation which did take place in the West following the collapse of medieval Christendom that has resulted, as we know, in the tensions which presently afflict and threaten not just the West, but mankind as a whole. The spread of scientistic ideologies and the abuses of industrialism, however, may not be the last word in this evolution; something else, far more subtle, is beginning to emerge, which may indeed require the full resources of traditional metaphysics for its adequate elucidation. It was the French metaphysician René Guénon who forecasted more than half a century ago that modern "anti-tradition", which had been rampant in the West since the so-called Enlightenment, would give way to what he termed the "countertradition", a seeming revival of religious beliefs and sacred traditions which in reality is quite the opposite. It is to be noted that less than two decades after Guénon made this prediction. Western society was startled by the cultural explosion of the sixties. which began in England and the United States, and has since spread over much of the globe. We will not attempt, at this point, to delineate this multifaceted movement, with its various counter-cultures, its drug cult and rock music, its sexual aberrations. its militant feminism, its barbarized "yogas",

its pseudo-spiritualities and so-called New Age ideologies; suffice it to say that it is this – and not the crude materialism of bygone days – that now threatens society. And whereas numerous manifestations of what may loosely be termed the New Age movement are plainly subversive, it is only in light of traditional data that the anti-traditional thrust of its more refined and "respectable" aspects can be discerned. I would add that various religious traditions, in the East and in the West, have predicted a phenomenon of this kind (often in almost identical terms!), and have depicted "the latter days" as a period of great trials, when false prophets shall appear in abundance and vast segments of mankind shall be deceived. We do not know exactly when this apocalyptic scenario will be realized, or whether perhaps it may have already begun; permit me however to recall a dictum which is to be found in many traditions, from our own "**vincit omnia veritas**" to the Hindu "**satyam eva jayate**": Truth alone will triumph in the end. As one reads in the Koran: "Truth has come and falsehood has perished".

Dr. William R. Stoeger

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Education: A.B. in Philosophy and Physics, 1967, Spring Hill College; M.S. in Physics (1969), University of California at Los Angeles; S. T. M. (Theology) 1972, Jesuit School of Theology, Berkeley, California; Ph.D. in Astrophysics (1979), University of Cambridge.

Postgraduate Experience: Lecturer in Physics (1969), University of San Francisco; Visiting Astromomer (1975), Vatican Observatory; Staff Astronomer (since 1979), Vatican Observatory; Faculty Research assistant in Physics and Astronomy (1977), University of Maryland; J.K. Russell Fellowship (1988-89), Center for Theology and Natural Sciences, Berkely, CA; Adjunct Associate Prof. of Astronomy, University of Arizona (Tusson, Arizona).

Discipline: Physics and Astrophysics; Philosophy and Theology.

Selected Publications: Over 45 Publications.

1. What is your definition of science and religion?

By "science" I mean the natural sciences, as they are now practiced – astronomy, physics, chemistry, biology, experimental psychology, and their sub-disciplines. These investigate the regularities, processes and structures of physical and biological reality insofar as they can be subsumed under general laws. This is pursued by the interactive procedure of constructing models or theories and of performing properly designed experiments and observations to test them. The hypothetico - deductive method is central to this procedure. As a result, our models and theories of the regularities and structures of the material world are gradually refined and improved, though they always are provisional, and will never be fully adequate. They thus constitute a detailed description of the make-up of the objects and relationships which constitute reality as we know it, and, to some extent provide limited explanations for the way it behaves.

"Religion" is a much more difficult word to define. I insist on carefully distinguishing among "faith", "theology", and "religion". All of these are related, but they are all different from one another. "Faith" is essentially our positive individual or communitarian response in acceptance of and commitment to perceived divine revelation. "Theology" is our ongoing reflection on that perceived divine revelation, and most importantly on the individual and communal experience of living out our commitment to and acceptance of it. "Religion", strictly speaking, is the organized, institutional social embodiment a believing community gives to its particular discernment and articulation of divine revelation, and to its ways of living, praying, working, and relating to God, to the world, and to one another in that shared faith commitment.

2. Do you see any conflict between your definitions of these two concepts?

No, there is no essential conflict between my definitions of "science" and of "religion" (or "faith" or "theology").

3. Where do you think there may be a conflict between these two?

A conflict can occur between science and religion, when one or the other oversteps the proper limits of its own competency and infringes those of the other. For instance, if religion or theology interprets the perceived revealed truth to affirm something about the natural world which contradicts what the natural sciences have discovered, then we have conflict. Or, going in the other direction, if the natural sciences conclude, or claim that they can conclude, to statements about God or God's activity, or values, or what is right and wrong, then there is potential for conflict with religion.

4. What have been the grounds for the development of conflict between these two?

Specific examples of what I have mentioned above would be: 1. Religion claiming that revelation dictates that the structure and organization of the universe is one way, whereas the natural sciences discover it to be another way (geocentric vs. heliocentric); 2. Religion claiming that the development of life and living beings occurred by God's direct and specific creation of each species, whereas the natural sciences determine that it happened through evolutionary processes; [in both these cases there was a lack of awareness of the proper limits of each way of knowing]; 3. The current affirmation by many representing science that, since God is not needed at the level of scientific explanation, God is not needed at all; 4. The current tendency of some scientists to extend or generalize a legitimate conclusion of the sciences to situations far beyond what scientific justification warrants - e. g. in some applications of the sociobiology of insects and animals to human beings, without further careful investigation.

5. What has been the role of religion in the development of science in the West?

Though I am not either an historian, or an historian of science, I believe that it has been fairly well argued that the Judeo-Christian theological traditon strongly encouraged the investigation of na-

ture through the interplay of observation/experiment and theory: 1. By emphasizing that human beings have a duty and a right to care for and to use nature; 2. By desacralizing or demythologizing nature and natural processes – so that, though they are seen as gifts of God, they are not seen as divine in themselves; they are for human beings, and for God's glory; 3. By declaring that all things are essentially good, and well-ordered, since they are God's creation – therefore to find out more about them is good, and possible, since their inter-relationships are regular and rational.

6. Can we have a religious science?

Strictly speaking we cannot have a religious science, since science itself, by its very nature, prescinds from perceived divine revelation. There is no place for special divine revelation – that is, divine revelation beyond God's revelation of God's self in the laws and processes of nature – in the methods of science. It cannot count as scientifically acceptable evidence.

7. Can science dispense with religion?

This question is ambiguous. In light of the above, science can dispense with religion – in the sense that, in order to do good science, we do not need religion, theology, or religious faith. In fact, if we relied on religion to do science, we would certainly do very bad science. However, this does not mean that the values, attitudes and convictions fostered by religion are without significance for science. Apropos of what we briefly stated in Question 5, it is possible that the social and cultural climate generated or reinforced by a given religion would either strongly encourage or strongly discourage, or even outlaw, scientific investigation. This has happened in the past, and it happens in some contexts now. Finally, referring to a rather different meaning this question might have, science can not legitimately do away with religion, or render it superfluous. This is simply because science is not competent to adjudicate questions relating to the authenticity of divine revelation, of belief, of human values, or of the ontological status of their objects. Faith and religion will always be an important part

of any culture, and an important and essential component of individual and communal human experience. Science and technology will also be components of cultures, to a greater or less extent. Within a cultural context, there is no essential conflict between the scientific and the religious realms - though tension and conflict may certainly occur and dominate in a given situation, for the reasons we mentioned above.

8. Can one separate the domains of activity of science and religion completely?

This cannot be done. First, science and religion will share the same cultural field, and so they will always interact in different, often automatic and unreflective, ways within that field – through education, massmedia, technology, pervasive symbols and images and values, intersecting communities of interest. Secondly, at the personal level, almost all persons within a culture will be affected by both religion and science – one way or another. Each individual will either integrate, or fail to integrate, these perspectives. Some will have strong commitments to both at the same time, which is now the case in all Western countries.